REPORTS, RETURNS, AND STATISTICS

OF THE

INLAND REVENUES

OF THE

DOMINION OF CANADA

FOR THE FISCAL YEAR ENDED MARCH 31

1918

PART III

ADULTERATION OF FOOD

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1918

TABLE OF CONTENTS.

REPORT

OF THE

ASSISTANT DEPUTY MINISTER OF INLAND REVENUE.

OTTAWA, July 15, 1918.

To the Honourable ARTHUR SIFTON,
Minister of Customs and Inland Revenue,
Ottawa, Ont.

HONOURABLE SIR,—I have the honour to herewith submit a report of the work performed by the Laboratory of the Inland Revenue Department during the fiscal year ending on the 31st of March, 1918.

It is unnecessary that I should deal in extenso with the activities of the Laboratory during the past fiscal year, as the essential details will be found in the report of the Chief Analyst which is as follows:—

The work of the Laboratories Branch concerns not only the main laboratories at Ottawa, but the sub-laboratories at Halifax, Winnipeg and Vancouver. These branches have been in successful operation during the year, and the following reports from the analysts in charge furnish details of the work done in each.

HALIFAX SUB-LABORATORY.

No. samples received.	Number reported.	Description.	Date of report to Chief Analyst.
.....	35	Butter	April 10, 1917.
.....	27	Chop feed	" 10, 1917.
.....	66	Evaporated fruit	" 10, 1917.
.....	60	Black pepper	" 10, 1917.
.....	8	Peanut butter	" 10, 1917.
72	72	Fertilizers	June 11.
28	28	Liniment of camphor	July 12.
43	43	White pepper	" 12.
49	49	Table salt	" 25.
39	39	Shorts and middlings	" 18.
60	60	Breakfast foods	" 17.
15	15	Cream of tartar	" 12.
34	34	Flour	Oct 15.
28	28	Liquid extract cascara sag	" 15.
29	29	Registered stock feeds	" 16.
32	32	Sodium phosphate, plain	" 16.
38	38	" " effervescent	" 16.
27	27	Wines, and other liquors	" 18.
30	30	Fruit flavors	" 30.
52	52	Canned fish	Nov. 9.
30	30	Sausages	" 19.
45	45	Beans	" 2 & Nov. 20.
26	26	Allspice	" 23.
23	23	Salad oil	Jan, 10, 1918.
30	30	Canned corn	Jan. 23.
20	20	Cheese	" 23.

HALIFAX SUB-LABORATORY—*Con.*

No. samples received.	Number reported.	Description.	Date of report to Chief Analyst.
20	20	Molasses.	March 2.
20	20	Sugar .	" 2.
10	10	Liquor arsenicalis.	" 9.
11	11	Honey.	" 23.
20	20	Marmalades.	" 30,
28	.....	Proprietary and patent medicines.	
31	.....	Medicated soaps.	
28	.....	Condensed milk.	
20	.....	Unfermented grape juice.	
37	.....	Bran.	
11	.....	Phosphates, baking powder, etc.	
986	1,027		
142	142	Malt liquors for export.	
1,128	1,169		
25	25	Beans, Asiatic, for import.	
10	10	Canned soup, for importation.	Feb. 5, 1918.
54	54	Special samples, as follows— 23 alcohol tests, in beer, etc. 10 fertilizer materials. 12 jams, for militia dept. 4 evaporated milk, for militia dept. 1 pepper. 1 corned beef. 1 cloves. 1 butter. 1 lemon extract.	
1,217	1,258		

Total number of samples received	1,217
Number received before March 31, 1917	196
Total number samples reported	1,258
Work in hand, March 31, 1918, not reported	155
Fees collected for analysis of above special samples, and sent to department.	$116 00
Soda solution sent to C.I.R., St. John, N.B.	1 winchester.
Normal sulphuric acid	1 bottle.

WINNIPEG SUB-LABORATORY.

	No. of Samples reported.		No. of Sample reported.
Peanut butter	5	Registered stock feeds	15
Milk	10	Soaps	42
Table salt	30	Beans	58
Breakfast foods	30	Flour	38
Fertilizers	41	Salad oil	23
White pepper	30	Cheese	36
Shorts or middlings	30	Strained honey	27
Linimentum camphoræ	15	Liquor arsenicalis	33
Canned fish	38	Sugar	37
Sodium phosphate effervescent	32	Molasses	36
Sodium phosphate plain	27	Marmalade	43
Wines and liquors	11	Liquid patent medicines	31
Canned corn	43	Foods that may contain calc. phos	33
Allspice	41	Bran	37
Cascara sagrada	32	Unfermented grape juice	17
Fruit syrups or flavours	20		
Sausages	41	Inspector's samples	982

OCCASIONAL SAMPLES.

	Samples.		Samples.
Vinegar	1	Evaporated apples	4
Butter	11	Soup, canned	1
Beer	26	Shorts	1
Milk	7	Feed	1
Cream	4	Maple sugar	2
Wine	4		90
Beer "Heading"	1		
Well water	1	Inspectors' samples	982
Vanilla extract	1		
Beans	25	Total	1,072

The following excise solutions were also furnished :—

Normal soda solution	30 winchesters.
Normal sulphuric acid	2 4=oz. bottles.
Phenolphthalein solution	7 8=oz. bottles.

VANCOUVER SUB-LABORATROY.

Date.	Collection.	Total.
May 16, 1917	Fertilizers	36
June 7, 1917	Salt	28
June 11, 1917,	Breakfast foods	59
June 15, 1917	White pepper	29
June 30, 1917	Shorts and middlings	30
June 30, 1917	Liniment of camphor	15
July 21, 1917	Fruit flavours	10
September 1, 1917	"	20
September 6, 1917	Canned fish	30
September 21, 1917	Registered stock feeds	18
October 19, 1927	Flour	30
October 23, 1917	Sodium phosphate	41
November 9, 1917	Beans	44
November 14, 1917	Sausage	20
November 27, 1917	"	2
December 6, 1917	Canned corn	29
December 18, 1917	Cascara	26
December 18, 1917	Allspice	27
January 25, 1918	Wines and liquors	22
January 28, 1918	Soaps	34
February 26, 1918	Patent medicines	32
March 6, 1918	Sugar	15
March 9, 1918	Cheese	20
March 20, 1918	Molasses	12
		629

SPECIAL SAMPLES.

Apples, evaporated	23	Lemon extract	2
Beans containing hydrocyanic acid, Lima	2	Mustard	1
Burma	196	Oil, fuel	1
Beans free from hydrocyanic acid	514	Soup, import	4
Beer for export	16	Wine	3
Butter for Department of Agriculture	11		776
Cider	2	Regular samples	629
Corn	1		1,405
Dynamite	1		
Egg-yolk powder	1		

The Halifax laboratories are located in rented quarters at 50 Bedford Row.

The Winnipeg laboratories occupy a portion of the first flat in Postal Station B, corner of Magnus and Main Streets.

The laboratories at Vancouver are situated in the Customs Examining Warehouse, 326 Howe Street.

The technical staff of these laboratories including the staff at Ottawa, at present comprises 24 analysts.

The following brief synopsis shows the work which has been done during the year:—

ANNUAL REPORT—FISCAL YEAR 1917-18.

Number of Bulletin.	Nature.	Number of samples.	Number of Bulletin.	Nature.	Number of samples.
369	Vanilla extract	125	383	Packaged breakfast food	275
370	Glycerin	230	384	Middlings	203
371	Nature's plant food		385	Table salt	198
372	Borax	55	386	Cascara sagrada	162
373	Butter	228	387	Beans	318
374	Chop feed	161	388	Reg. stock feeds	146
375	Evaporated fruit	289	389	Flour	237
376	Peanut butter	33	390	Flavouring syrups	141
377	Human food		391	Canned fish	275
378	Fertilizers	349	392	Sausages	164
379	Ground black pepper	345	393	Sodium phosphate	313
380	Headache powders	102	394	Wines and liquors	114
381	White pepper	208	395	Canned corn	207
382	Lin. of camphor	94	396	Salad oil	149
				Total	5121

The following occasional work has been done.

Acetic acid	83	Dubbing	1	Peas	1
Acetyl sal. Tablets	2	Ether	3	Pepper	3
Acid	1	Evaporated milk	7	Petroleum	1
Alcolene	2	Fertilizer	19	Pomax	1
Allspice	1	Flax chaff	1	Porter	2
Anocain tablets	1	Flour	1	Salad oil	2
Apples	1	Fusel oil	9	Salicylic acid	1
Barium sulphate	2	Gasolene	2	Sargol	1
Beans	110	Hop malt	1	Sediment	1
Beer	58	Ink	1	Shorts	1
Benzol	12	Izal	3	Silver nucleinate	1
Bran	1	Jam	33	Soap	14
Bread	2	Lemon extract	1	Sod. salicylate	1
Butter	24	Liquors	5	Spirits	123
Candy	1	Lithium	1	Sterilized milk	2
Canned salmon	2	Lobsters	1	Strychnine	1
Canned soup	12	Malt coomings	6	Sugar	3
Canvas	6	Malt flour	3	Tincture iodine	1
Caramels	1	Maple sugar	7	Toluol	1
Cattle feed	3	Maple syrup	8	Turpentine	2
Cheese	30	Mercury	1	Vanilla extract,	2
Chloroform	2	Middlings	2	Vinegar	4
Cigarettes	2	Mil-Co egg	1	Water	12
Cloth	7	Milk	34	Wine	4
Cocaine	1	Nerveline	2	Witch hazel extract	1
Condensed milk	1	Nerve tonic	1		
Condition powder	1	Nutmegs	4	Total	741
Cotton seed flour	1	Nux vomica, fluid extract	1		
Cyanide potassium	1	Oleoresin vanilla	1	Vinegar tested for excise	221
Crystals	1	Oil	16	Normal soda	110
Denatured alcohol	2	Oil cedar	1	" acid	4
Disinfectant	6	Paint	36	Phenolphthalein	16
Dried corn	1	Peanut butter	1		

SESSIONAL PAPER No. 14

A large amount of work, advisory and analytical, has been performed for various departments of government service, in addition to the above. Much attention has been given to revision of food standards and the acquiring of such information as should justify recommendation of constants for articles not yet standardized.

Flavouring Extracts.—Revised standards were established by Order in Council, March 31, 1917 (published as G. 1276, April 7, 1917).

Tea.—Revised standards by Order in Council of April 18, 1917 (G. 1277, April 21, 1917).

Grain Products.—Re-written and established by Order in Council of December 3, 1917 (published as G. 1292, December 10, 1917).

Pepper.—Standards authorized by Order in Council of February 20, 1918 (published as G. 1297, February 26, 1918).

Baking Powder.—Standards by Order in Council of March 8, 1918 (published as G. 1298, March 13, 1918).

As was done in my report of last year, I forward you the introductory matter only of the bulletins issued during the year. Any one interested in details of analysis, not therein given, may obtain copies of the bulletins by applying to yourself, or to me.

It is fitting to note that the late Dr. G. P. Girdwood, of Montreal, tendered his resignation as a member of the Board of Examiners in March, 1917, consequent upon illness which made it no longer possible for him to perform the duties of office. His death occurred Oct. 2, 1917. Dr. Girdwood had much to do with the framing of the Adulteration Act, and was a member of the Board of Examiners since its formation in 1886. He always took a sincere and active interest in the working of the Act, as indeed he did in many directions, for the benefit of the public in matters of health. He is succeeded on the Board of Examiners by Prof. R. F. Ruttan, of McGill University.

I have the honour to be, Sir,
Your obedient servant,

GEO. W. TAYLOR,
Assist. Deputy Minister.

BULLETIN No. 369—VANILLA EXTRACT.

OTTAWA, 16th May, 1917.

SIR,—I beg to hand you herewith a report upon one hundred and twenty-five (125) samples purchased by our inspectors as Vanilla Flavouring Extract in April, May, June and July of last year.

By an Order in Council of 17th October, 1912, the Flavouring Extract of Vanilla is required to be prepared from the Vanilla bean, and to contain in 100 cubic centimetres, the soluble matters from not less than 5 grammes of the bean. The usual solvents are ethyl alcohol, water and glycerin.

An artificial extract may be sold, if properly labelled so as to declare its character.

A more recent Order in Council, dated 31st March, 1917, amends that above referred to by requiring that, in the latter class of Flavouring Extracts, which by the way, are not really extracts, but solutions, the word Artificial or Imitation, or other equivalent word, shall appear on the label in type as large and conspicuous as that used in any other word on the label.

It is further required that the genuine extract of Vanilla shall contain no colouring matter other than that supplied by the Vanilla bean itself.

These amendments have been found necessary because investigation has established the fact that purchasers of these articles are not actually made aware of their artificial character when the label is printed in such a way as to give prominence to non-committal words, while the important descriptive word is printed in small letters. Further, the depth of colour of an honestly made Extract of Vanilla is a fairly good index to its strength, in other words, to the amount of actual bean material used in its preparation. It may be that consumers sometimes place too much reliance upon this feature, since the most fragrant kinds of bean do not always yield the darkest extracts; but in a general way, the depth of colour is approximately proportional to the weight of bean used. Of course it is permissible to add colour to artificial extracts, since the prominent word Artificial, Imitation, or Compound, sufficiently warns the purchaser regarding the nature of the article.

While the Adulteration Act is primarily written to protect the consumer, the fact must not be overlooked that it at the same time protects the honest manufacturer of a high class article, by requiring that inferior goods must be labelled in such a way as to properly inform the purchaser.

It may be well here to draw attention to a fact already pointed out in Bulletin No. 245; namely, that alcohol is necessary in preparing an Extract of Vanilla, not so much to dissolve the vanillin, which is rendered more soluble by the presence of sugar, as in order to get the characteristic resins into solution. For this reason an extract cannot meet the requirements of a true vanilla bean extract unless it contains from 30 to 40 per cent of alcohol. Samples containing notably more than 0·2 per cent of vanillin are presumably made with synthetic vanillin, or, are at least, fortified by addition of such vanillin.

As a check upon the test for resins; or as a substitute for actual separatio of the resin, some work has been done in these laboratories upon estimation of the lead number; the colour value of the extract, and determination of residual colour after precipitation with lead, according to a method described in Bulletin No. 152 of the U.S.A. Department of Agriculture. Results obtained show that substantial help in judging the quality of Vanilla Extract may be got from these determinations.

They desiderate, however, the employment of larger volumes of the sample than we usually are furnished with.

It need scarcely be said that, in the case of this collection, I have been guided by the requirements of the Order in Council of 17th October, 1912, which governed at the time of purchase.

Briefly, the results of analysis show as follows:

Samples found genuine	53
" sold as artificial, etc	54
" lost by breakage	3
" adjudged as doubtful	3
" adjudged as adulterated	12
Total	125

Adulteration consists in the Fact that the article, while artificial, is sold as genuine Vanilla Extract, or simply as Vanilla Extract, which amounts to the same thing.

It has not been considered necessary to carry out analysis, in all cases of samples sold as artificial, as compounds, or otherwise designated to show that these are not offered as genuine.

BULLETIN No. 370—GLYCERIN.

OTTAWA, April 30, 1917.

SIR,—I beg to say that, in consequence of complaints received by this Department, in November of last year, to the effect that adulteration of glycerin was suspected in certain localities, our inspectors were instructed to make a collection of this article, as offered at retail in drug shops and elsewhere.

During December of last year, and the first three months of the current year, two hundred and thirty samples were sent in for examination, with results which are detailed in the present report. These may be summarized as follows:—

Samples judged as genuine	194
" " as doubtful	6
" " as adulterated	30
Total	230

In order to render clear the grounds upon which the above judgments are made, the following explanations are necessary.

The tri-hydricalcohol glycerol is an essential component of all fats and oils; and is obtained from these by processes of saponification or hydrolysis. Glycerin may be regarded as the ordinary name for Glycerol, as this is found in commerce. Chemically pure Glycerol is not found in ordinary commerce. Its great hygroscopicity causes it to take up more or less water from the atmosphere, so that about three (3) per cent of water is present in the best commercial samples. The British Pharmacopoeia recognizes as Glycerin an article of specific gravity 1·260, which corresponds to about 3 to 4 per cent of water.

I have judged as genuine all samples which contain less than five (5) per cent of water.

Samples containing between 90 and 95 per cent of glycerol I have judged as *doubtful*. It is scarcely probable that the most careless handling of glycerin, could, account for the introduction of anything like ten (10) per cent of water into the article; so that when more than ten per cent water is present, I am compelled to infer that this has been added with intent. Such samples are judged as adulterated by addition of water; and this report shows that 20 samples come under this head.

Ten (10) other samples contain sugar syrup, which must, of course, be regarded as adulteration.

I would respectfully recommend that action be taken in the cases of 30 samples which are found to be adulterated, in accordance with explanations given above.

BULLETIN No. 371—NATURE'S PLANT FOOD.

OTTAWA, 13th April, 1917.

SIR,—I would respectfully call your attention to a gross fraud sought to be perpetrated upon the farmers of Canada by the sale of an article offered as Nature's Plant Food; the manufacturers having their Canadian Agency at Chatham, Ont.

The article in question is merely a crushed rock of the Syenite type, such as exists in limitless quantity at very many places in Canada, where it is used for macadamizing roads, and other purposes. I cannot call it a pulverized rock, since a sample examined from this point of view, in these laboratories, gives the following results:—

Finencss.	Passes 100 mesh sieve	50·9 p.c.
"	80 "	9·0 "
"	60 "	5·0 "
"	40 "	6·1 "
"	20 "	12·2 "
Held by 20 mesh sieve		16·8 "
		100·00

Basic phosphate and other slags, having vogue as fertilizers, are required to be ground so that at least 80 per cent passes the 100 mesh sieve, and the whole, as a rule, passes the 80 mesh sieve.

The same material was sold at various places in the United States as "New Mineral Fertilizer"; and the Director of the Maine Agricultural Experiment Station, at Orono, made a test of it in 1911. The results in detail are published in Bulletin No. 209 of the above mentioned station, and copies may be had by addressing Dr. Chas. D. Woods, Director. The following quotation shows results obtained on plots which were planted to potatoes and corn, and in each case treated as indicated.

1. No fertilizer was added.
2. A complete fertilizer was added.
3. The so-called New Mineral Fertilizer was added.

	Total Crop, Potatoes.	Pouuds, Corn.
1. Without any fertilizer	285	175
2. With good fertiiizer	346	450
3. With New Mineral Fertilizer	265	145

Our Fertilizers Act is intended to protect the farming industry by requiring that no fertilizer shall be sold unless it is registered, and carries a statement of its actual content in fertilizing material. Most, if not all, the States of the American Union, take the same precautions. It is in consequence of this that the promoters of this fraudulent enterprise have found it necessary to change the original name, and to describe their product otherwise than as a fertilizer.

Nevertheless, the material is actually sold as a fertilizer, and described to the farmer as such. Thus, a pamphlet published by Nature's Plant Food Co. contains the following statements: at page 9, "Why plant two acres of half fertilized corn, when by using our Plant Food you can raise more and better corn on one acre of ground? "Nature Plant Food can be applied to all growing crops by surface application, clear up to the time of harvesting and every application will show immediate results by forcing the plants to a more vigorous growth and greater yield." Page 15. "Nature's Plant Food, insures crops of palatable, finely flavoured vegetables, and juicy, aromatic, wholesome fruit." "If the land is in ordinary good condition and a general crop is to be raised, we advise using this Plant Food at the rate of 1,000 or more pounds to the acre." Page 15. "Strawberries; when setting out new vines, work about one ton per acre of this Plant Food into the top soil." Page 19. "This Marvellous Food contains the very minerals the soil craves, and the plants must have." Page 42. "As the source of the potash and the soda for the sugar beets, we can only consider Nature's Plant Food, which, thanks to God, is contained to a very slight degree in many soils, while the nitrogen is furnished by the atmosphere."

I hold that the above quoted statements, with numerous others, do convey to the reader, the idea that the article is a fertilizer, and that they are written with this intention. The whole trend of its advertising is to make the farmer believe that it is to all intents and purposes, an agricultural fertilizer; and anyone who purchases the material will, to that extent, be certain to curtail his purchase of really valuable fertilizers.

It is, in reality nothing more than crudely pulverized rock, such as may be obtained from the siftings of any stone pile, where Syenite has been crushed for road making, and is not even ground to any uniform degree of fineness.

As a fact, nature's true plant food consists of the gases of the atmosphere, rain water, and the soluble constituents of fertile soil. Many soils are deficient in the more soluble ingredients, namely compounds of nitrogen, phosphorous and potassium, and less frequently of calcium. For this reason manufactured fertilizers seek to supply the missing substances. Compounds of nitrogen are normally the most costly of these, but for the last year or two, potassium compounds are held at excessively high price. The article now under consideration contains no nitrogen, and traces only of phosphorous and potassium; these traces being locked up in compounds which make them practically useless to agriculture. The other ingredients of this article are normally present in sufficient quantity in all ordinary soils, and their purchase at any price, is unwarranted; while at $30.00 per ton, the matter becomes sheer waste of money.

It would be bad enough at any time to spend money for worthless material, under the delusion that one was buying an agricultural fertilizer; but it becomes a positive crime just now, when because of war conditions we are asked to make our farms as productive as possible. The purchaser of this material is not only buying that which has no agricultural value; but he is thereby prevented from purchasing effective fertilizers; and losing the season.

Mr. Inspector Forde of this Department has just returned from Rumford, Maine, where the company is stated to have its mills. He reports that a nickel mine, some ten and a half miles from Rumford, closed down six or seven years ago, and was reorganized later by a Mr. McCrellis, with a view to selling the crushed rock as New

Mineral Fertilizer. A number of farmers, and others, in the locality were interviewed, and without exception denounced it as a fake. A few of the statements made may be quoted:—

Mr. James S. Morse, member of the State Legislature, says: "They have prohibited the sale of it in the State of Maine, as it is absolutely no use."

Mr. Jerry Martin: "Have tried the stuff: it is no good; don't ask me to recommend it; my crops were much better where none was used."

Mr. F. A. Coffin: "Yes, I have used this fertilizer, and consider it useless. I might just as well grind up the rock on my own farm, and use the money."

Mr. T. J. Goddard: "Have used the stuff; it is no use; spoiled my crop; it is only a fake."

Mr. Allen, of Allen, Sterling and Lothrop: "We sell several kinds of fertilizers, but never handle this particular one, as we know it to be a fake."

It seems scarcely necessary to quote further; because the fraudulent character of the article is sufficiently indicated in the way it is advertised.

Most of the statements made in the pamphlets are garbled extracts from various publications, and many of them are patent falsehoods. Thus, on page 25 of the larger pamphlet is the following: "I have recently had one of the best chemists in Boston make careful tests as to the solubility of the material, with nothing but pure rain-water. He found, in five days' time, after filtering through a filter paper, that 5·9 per cent had become soluble, without changing the water in the test tube. In fourteen days, 17 per cent went into solution with pure rain-water. In twenty days, 27 per cent went into solution." It goes without saying, that rocks of this kind are insoluble in rain-water; and it is because of their insolubility in rain-water that they persist. In order, however, to meet the above ridiculous statements by direct evidence, I caused the actual test to be made, and found the water soluble matter, in five days, to amount to 0·095 per cent or less than one-tenth of one per cent.

In a land of free speech like ours, where every fad, social, religious, political, or other, has its apostles, it need not be regarded as wonderful that even the legitimate use of fertilizers should find voluble opponents. I am aware that advocates of so-called "clean culture" are in evidence (see Sampson Morgan in The Vegetarian for March 1917, reprinted in Chemical News of March 16th, 1917.) But the advocacy of this absurdity is one thing, and the attempt to sell by fraudulent means a broken rock at fifty times its value is quite another thing.

As the spring season is upon us, and the demand for fertilizers is very great, I would respectfully press upon you the necessity of immediate action, in the interests of our farmers, who are having this useless article pressed upon their attention by self-interested agents. I would suggest the immediate publication of this letter, in an edition of 10,000 copies; and ensure its effective distribution by our inspectors, and through the manufacturers of registered fertilizers. Agricultural papers will doubtless give it additional publicity.

BULLETIN No. 372—BORAX.

OTTAWA, May 18, 1917.

SIR,—I beg to hand you a report upon fifty-five (55) samples of Borax purchased by our inspectors in October and November of last year.

This article is chiefly employed for laundry purposes, and most of the samples herein reported were packaged and labelled as intended especially for such use.

Borax is, however, very largely employed as a food preservative, particularly in meats, meat products, butter and cream. It is also used as a mouth wash, as an eye-lotion, and for general antiseptic purposes. For such use, it should be free from more than traces of arsenic, and should, of course, be true to name.

An Order in Council of October 24, 1912 (published as G. 1048) limits the amount of arsenic permissible in borax for use in foods, to 4 parts per million. Such a degree of purity is perhaps not to be expected in borax as employed for laundry purposes.

The addition of carbonate of soda to borax is only explicable on the assumption that the manufacturer desires to cheapen his product, or to mislead the purchaser with a view to enhanced profit to himself. Unless declaration of the presence of carbonate of soda is made at the time of sale, either by verbal statement or by statement on the label, such admixture must be regarded as adulteration under the Act. (Section 3, (b).)

Borax is quoted on the New York market on May 5, 1917, at $8 per 100 pounds; *Bicarbonate of Soda,* at $1.95 per 100 pounds and *Sal Soda,* at $1.05 per 100 pounds. (Metallurgica & Chemical Engineering, Vol. XVI, No. 10, p. 619.)

It may be assumed that manufacturers intending to introduce borax into foods as a preservative, would not purchase the article without a guarantee of its freedom from arsenic; in other words, that borax as sold for laundry purposes should not be expected to meet the rigid standard set for borax as a food preservative.

A considerable number of the samples herein reported, are found to contain much more arsénic than 4 parts per million; some indeed showing from 50 to 100 parts per million. While an article of this quality may be decidedly objectionable or even dangerous, if employed in cream or butter, I have merely drawn attention to those cases in which excess of arsenic has been found, without charging adulteration under the Act. It may be sufficient to emphasize the fact that borax for food preservation, should be purchased with a trustworthy guaranty of purity, and that ordinary commercial borax is quite unfit for such a purpose.

The following synopsis of results, presents the matter of this report at a glance:—

	Samples.
Found genuine, and without excess arsenic	21
Found genuine but with excess arsenic	19
Found to contain carb. soda, declared	2
Found to contain carb. soda without declaration and therefore adulterated	13
Total	55

BULLETIN No. 373—BUTTER.

OTTAWA, May 18, 1917.

SIR,—I beg to hand you a report upon 228 samples of Butter, procured by our inspectors during January, February and March of the present year.

This collection was made in consequence of many complaints, suggesting the extensive sale of oleomargarin as butter, or as a butter substitute. It is gratifying to know that not a single sample of the article was obtained by our inspectors; although this may not be held as conclusive proof that oleomargarin is entirely absent from our markets. Another complaint to the effect that excessive amounts of water were frequently incorporated into butter, appears to be substantiated by the fact that seven

(7) samples contain decidedly more water than the 16 per cent fixed as a maximum permissible limit; while sixteen (16) other samples nearly reach, or slightly exceed this limit.

Legal butter should contain approximately 82·5 per cent of milk fat. Slightly less than this amount may be present in samples of butter which contain maximum, or nearly maximum amounts of water, salt and curd; but as a rule, the defection does not exceed one or two per cent.

Thus, nearly 90 per cent of the samples (138 in number) reported in Bulletin 334, and collected in October, November and December of 1915, contained at least 82·5 per cent fat, many of them considerably exceeding this limit. Of the present collection, representing 228 samples, 187 samples contain at least 82·5 per cent of fat. (82 per cent of the total collection.)

Since milk fat is the most valuable constituent of butter, it is important that any deficiency, below 82·5 per cent should be small. Six samples show deficiencies varying from 5 to 13 per cent of fat.

No admixtures or substitutions of foreign fats, instead of milk fat occur.

BULLETIN No. 374—CHOP FEED.

OTTAWA, May 21, 1917.

SIR,—I beg to hand you a report upon a Stock Feed, purchased as "Chop Feed" by our inspectors in January, February and March of the present year. One hundred and sixty one (161) samples have been examined, with results which may be sumarized as follows:—

	Samples.
Found genuine	123
Found genuine as to feeding value, but containing an excess of noxious weed seeds	29
Found nearly of minimum value and passed (one sample with excess weed seeds)	5
Found adulterated under the Act	4
Total	161

So far as the nutrient value of this class of Feeds is concerned, our standards require Chop Feed to possess:—

Protein	At least 10 per cent.
Fat	At least 2 per cent.
Fibre	At most 10 per cent.

Chop Feed is defined as whole grain of one or more kinds, more or less finely ground. The known variations in value possessed by different grains are so great that, of necessity, this class of feed must vary greatly in its protein and fat. Examination of this report will demonstrate that the commercial article, while approximating to 10 per cent of protein, greatly exceeds this limit in many instances, and particularly is this the case where peas (or beans) are employed in its manufacture. There is a temptation, in such cases, to reduce the protein percentage to standard minimum requirements by adding fibrous material, such as oat-hulls. This, of course, constitutes adulteration under the Act.

It seems to me that a much better way of assuring recognition of value, above minimum value as fixed by law, would be for the manufacturer to register his product, and to sell it under a guarantee of value, such as is required in the case of mixed feeds. This is done by comparatively few manufacturers of Chop Feed.

The difficulties in the way of taking this course, are evident in the case of the smaller mills, whose chief business is of a local character, and who do not carry a large enough stock to justify the expense of analysis and packaging. There should be no special difficulty in the case of the larger manufacturers.

In Bulletin No. 191 (Nov. 1909) which deals with the subject of Stock Feeds, I have discussed the advantage to both manufacturer and consumer which would result from more specific description of this article (Chop Feed); and the arguments there adduced are strengthened by the present report. Until definite action is taken however, we must recognize Chop Feed as an article which is required to possess a protein value of 10 per cent, a fat value of 2 per cent, and a crude fibre content not exceeding 10 per cent by weight.

Strict interpretation of the meaning to be given to regulations limiting vital weed seeds in Feeding Stuffs, has not yet been formulated.

BULLETIN No. 375—EVAPORATED FRUIT.

OTTAWA, June 11, 1917.

SIR,—I beg to hand you a report upon the examination of 289 samples of evaporated or dried fruits.

The samples in question were variously collected by our inspectors in January, February and March of this year, and were put in hand for analysis within a few weeks of their being furnished to the laboratories, meantime being kept in cold storage, in order to prevent any important change in character.

This inspection was intended to have special regard to the content of sulphurous acid, which is understood to be extensively used for bleaching purposes, in such fruits as are desired to be light in colour, as well as for preservative purposes, the antiseptic properties of free sulphurous acid being well known.

In July, 1907, the Department of Agriculture at Washington established conditional regulations respecting the amount of sulphurous acid permissible in foods and food products containing acetaldehyde, sugars, etc., with which sulphurous acid may combine; and decided to institute no prosecution if the total amount of sulphur dioxide in the finished product did not exceed 350 parts per million, of which not more than 70 parts were free sulphur dioxide.

Later (March, 1908) Food Inspection Decision No. 89 decreed as follows: "No objection will be made to foods which contain the ordinary quantities of sulphur dioxide, if the fact that such foods have been so prepared is plainly stated upon the label of each package.

An abnormal quantity of sulphur dioxide placed in food for the purpose of marketing an excessive moisture content, will be regarded as fraudulent adulteration under the Food and Drugs Act of June 30, 1906, and will be proceeded against accordingly."

In the absence of definite statement regarding "ordinary" and "abnormal" quantities of sulphur dioxide, it would naturally be difficult to make the above regulations effective and useful; and I am not aware that any prosecutions have been undertaken by the United States Federal authorities in the matter.

Individual States have, however, taken definite ground; and the following letter to the trade, by Commissioner E. F. Ladd of North Dakota (Am. Food Journ., February, 1914) shows the attitude of that State in the matter:—

DEAR SIR,—I beg to call your attention to the fact that at the present time considerable quantities of dried fruit, which are not permissible under the provisions of our law, are being shipped into the State of North Dakota.

Sulphur dioxide is prohibited in food products in North Dakota, and yet I have not strictly enforced this feature of the law where dried fruit contained only a slight amount of sulphur dioxide. The tentative standard of 350 mgs. per kilogram of fruit as announced by the Bureau of Chemistry under the National Law, is certainly being exceeded at the present time in that some of the samples recently analyzed have been found to contain from 600 to 750 mgs., or more than double the standard referred to. Such dried fruit must be removed from the State.

The Department does not recognize as legal, in the State, ráisins, silver prunes or figs bleached with sulphur dioxide as we have not been convinced that there is any necessity, in a good article, for the use of sulphur dioxide in either one of these products.

You are hereby notified that a strict compliance with these provisions is requested on the part of all who are handling dried fruit in this State.

E. F. LADD,
Food Commissioner.

Your advisory Board has made a careful study of the question of sulphurous acid in foods; and consequent upon its recommendations, an Order in Council dated 4th April, 1914 (published as Circular G. IIII) limits the amount of sulphurous acid which may be present to 1 part in 10,000 parts in beverages, and 1 part in 2,000 parts in solid foods; the presence of sulphurous acid must be declared on the label, or otherwise.

The above permitted amounts corresponds respectively to 100 and 500 parts per million; and if they be interpreted as referring to sulphurous acid in the free state, they are much more liberal than the tentative limits established under Food Inspection Decision 75 U.S.A.

They are, nevertheless, greatly exceeded by many samples herein reported, and I have drawn attention to the fact that sulphurous acid is in excess, whenever the amount found reached 2 parts per 2,000, that is, twice the amount fixed as a limit under Order in Council of April 4, 1914. This occurs in 29 samples of dried peaches and 16 samples of dried apricots.

In greater detail, the results of this inspection may be thus exhibited:—

—	Currants.	Peaches.	Apricots.	Apples.	Pears.	Figs.	Prunes.
Found genuine		31	32	70	9	40	13
Found to contain sulphurous acid in excess, but otherwise of good quality		20	9				
Found to contain sulphurous acid in excess, but otherwise of fair quality		8	6				
Found to contain sulphurous acid in excess, and otherwise of doubtful quality		1	1				
Of doubtful quality without excess sulphurous acid		7	10	12	4	4	
Unfit for food, by reason of dirt or decomposition	1	2	5	5	3	1	1
Adulterated by excess water				4			
Total samples	1	69	53	91	16	45	14

While it would be proper to describe as *adulterated* all samples containing more than 1 part of sulphurous acid per 2,000 parts by weight of material, I would respectfully suggest the publication of this report as being the first systematic inspection, in this regard, under the Order in Council of April 4, 1914, with a warning to the effect that declaration of bleaching by sulphurous acid will hereafter be exacted. Most of the fruits thus coming under criticism are apparently of foreign origin; and it is noteworthy that no free sulphurous acid is found in any of the samples of evaporated apples, essentially of Canadian origin examined.

An Order in Council of March 16, 1916 (published as G. 1238) fixes the limit for water in Evaporated Apples at 25 per cent. Under earlier order (October 17, 1912, published as G. 1044) fixed the limit at 27 per cent which further investigation proved to be inconsistent with good keeping quality.

Four samples of evaporated apples are found to contain excess water; and three of these are distinctly fermented, as was to be expected. All must be condemned as adulterated under the Act. Eighteen samples of fruit are found to be unfit for food, and adultered under section 3e, of the Act; which describes as adulterated any food consisting wholly or in part of a diseased or decomposed or putrid or rotten animal or vegetable substance. Dirt is not specially mentioned as constituting adulteration; but mouldiness, the presence of worms, and excrementitious matter, must be held to justify condemnation under the subsection referred to.

The samples now indicated comprise:—

Peaches	2	samples
Apricots	5	"
Apples	5	"
Pears	3	"
Figs	1	"
Prunes	1	"
Currants	1	"

It is of course quite possible that the packer is not responsible for the character of this fruit as sold.

BULLETIN No. 376—PEANUT BUTTER.

OTTAWA, June 8, 1917.

SIR,—I beg to hand you a report upon 33 samples purchased by our inspectors as Peanut Butter.

This article appears to be essentially the roasted and ground kernel of the peanut (Arachis hypogœa). Its average composition, as found by analysis of the samples herein reported, is as follows:—

Average composition.

Acidity	25	Samples	2.34 N	per 100 grammes.
Water	33	"	1.41	per cent
Protein	33	"	27.45	" "
Fat	33	"	47.55	" "
Sugars	20	"	5.58	" "
Starch	20	"	7.56	" "
Fibre	20	"	1.22	" "
Salt	33	"	1.18	" "
Ash (Including salt)	33	"	3.03	" "
Refractive index of fat, at 25° C				1.4695
Iodine number of fat				93.2

U. S. Standards (Leach, Foods Xc. 2nd Edn. p. 522).
Refr. Index at 25° C 1.4690 to 1.4707.
Iodine number 87 to 100.

The mean composition of a number of samples analyzed at the Connecticut Agricultural Experiment Station, and purchased as Peanut Butter, or Peanolia, is as below; (Wiley, Foods, etc., 2nd Edition, p. 421).

	Peanut Butter.	Peanolia.
Water	2.10	1.98
Protein	28.66	29.94
Fat	46.41	46.68
Sugar and Dextrin	6.13	5.63
Starch	6.15	5.58
Insoluble cellulose	2.30	2.10
Common salt	3.23	4.95
Ash	0.80	1.08

The analysis of ground peanut cake is thus given by Bolton and Revis. (Fatty Foods, 1913, p. 204).

Moisture	10.68
Oil	5.81
Carbohydrates	30.49
Proteids	45.12
Fibre	3.84
Ash	4.06
Sand	0.23

This represents the natural and unroasted nut, decorticated.

Peanut butter is a highly nutritious and wholesome food material; and so far as this examination goes, it appears to be furnished, to the Canadian consumer, without any adulteration. This is the first occasion upon which the article has been subjected to inspection by this department.

BULLETIN No. 377—HUMAN FOOD, CONSIDERED IN ITS RELATION TO QUANTITY AND COST.

Ottawa, June 12, 1917.

It is pleasing to know that there exists a large class of Canadians of sufficient means to choose their food without regard to its market cost. Their selections are guided solely by considerations of palatability, nutritiveness and fashion, which generally means strawberries in winter, and unseasonableness throughout the year. It is not for people of this class that I am writing.

A very much larger class of our people is compelled, in these days of high prices, to consider somewhat closely the cost of food; and perhaps the largest class of all finds it necessary to reduce expenditure in matters of education, clothing and amusements in order to pay the grocer's and butcher's bills.

It may seem audacious in me to say that I am convinced that a very little elementary knowledge of well ascertained facts concerning the meaning of nutrition, and the actual utilization of food in the maintenance of life, might reduce the cost of our food fully fifty per cent, without any sacrifice of physical well-being. I have, however, given this matter very careful study, and I do not hesitate to make the above statement, quite deliberately.

Where then lies the difficulty in effecting this economy? Just here, that in order to practical results, the modicum of knowledge above referred to must be possessed

not by the university professor, or even by the student, but by the average housewife, to whom is entrusted the marketing and the cooking of our food.

This brief essay is therefore addressed to the housewife, and is intended to be perfectly comprehensible by those who have had no formal or academic training in chemistry or biology, or any other of the sciences with whose results it deals. As far as possible, I shall avoid the use of unfamiliar terms; and if exactness of statement must thereby suffer, I shall nevertheless assure the reader of a sufficient degree of accuracy to justify her confidence, and to ensure useful results.

SOME PRELIMINARY CONSIDERATIONS.

One man lives essentially on bread and milk, another on meat, potatoes and water. Both are healthy and apparently well nourished. We look at these men, examine them carefully, and find that, so far as we can judge, they are made of the same stuff. Had we no other source of information than our own observation we should find it impossible to say which man was made of bread and milk, and which of meat and potatoes. Even when subjected to the most thorough medical inspection, it is found that flesh, bone, blood, skin, cartilage, secretion and all other detail, are essentially alike in each.

Here surely is food for thought; and it ought to be perfectly evident that the food eaten by each, however different in name and in appearance, must have some common character; it is in each case, capable of transmutation into body material. And the special foods named are only particular cases of scores of purchaseable foods which could have effectively replaced them.

It must be sufficiently evident that, leaving out of account those foods which we eat, not because we need them, but simply for the pleasure of eating, food is needed for two main purposes—first, to build up the material of the body and to replace tissue which is wasted in life processes; second, to furnish energy, or the power to do work. For the human body is a machine in action; and like any other machine, must undergo constant repair, and be furnished with some motive power, in amount proportioned to the work it is required to perform. This power to do work, we call *energy,* and in order that we may speak definitely about energy we must have some unit of measurement of energy. When we want to speak of distance, we say so many miles; or of weight, so many pounds. In the case of energy, we use the *calorie* as our unit. It is not at all necessary to know that a calorie is the equivalent of an amount of energy, in the form of heat, that is required to raise the temperature of 1 litre of water through 1 degree Centigrade. It makes our thinking all the more definite to know this, as it does to know that a pound is 7,000 grains; or that it is the force of gravity at a certain latitude, acting upon a mass of platinum carefully preserved in the archives at Westminster. But such exact knowledge is quite unnecessary for our purposes. If I am travelling in Russia, where they measure distance in versts, and I am told that my rate of travelling is, 30 versts per hour and my destination is 300 versts distant, I can just as well calculate the time at which I shall reach home, as I would do if I knew what a verst actually was in yards or miles. Fix in your mind the term *calorie* as a measure of energy; and don't bother about its complete significance.

But remember that a man of 156 pounds weight, lying quietly in bed all day, requires to be supplied with 1,848 calories of energy if at the end of the day he is to be as well and strong as he was in the morning. If he sits up in a chair, all day, he will require 1,996 calories of energy, because the sitting posture demands more muscular effort; and if he moves about the house, or is at all fidgety, he must have 2,160 calories. A hospital patient of 156 pounds weight, must have more than this if he is to grow stronger, for the numbers given do not allow of added vitality, but merely the maintenance of initial vitality. If our man is to do any kind of work, he must of course, be supplied with additional calories of energy; and Rubner, the great German

authority on this subject finds an average of 2,445 calories requisite for such men as writers, draughtsmen, tailors, physicians, etc.

Actual computations of the diet of farmers, maintained in good health show the following:—

	Calories.
Farmers in Connecticut	3410
" Vermont	3635
" New York	3785
" Mexico	3435
" Italy	3565
" Finland	3474
Average	3551

(Lusk. Fundamental Basis of Nutrition.)

Lusk says: From the present available data one may estimate the daily energy requirement of a well-nourished adult (156 pounds) as follows:—

Occupation.

	Calories.
In bed 24 hours	1680
In bed 8 hours, work involving sitting in a chair 16 hours	2170
Bed 8 hours, in a chair 14 hours, moderate exercise 2 hours	2500
Farmers	3500
Rider in a 6-day bicycle race	10000

I want to impress upon you the importance of thinking in terms of calories when you are dealing with what we call vital energy. When you ask your friend "How do you do, to-day?" you are really asking him whether the energy that he expends in his daily life work is satisfactorily replaced by the energy that he derives from his food. If this is not the case, then he is starving.

Starvation.—Every human body, in a good state of health, represents a certain fixed income and outgo of energy, which we call the normal. If excess of food, more than requisite to maintain this normal is supplied, one or more of several things must happen. (1) The excess food may pass through the body unchanged or practically so—in which case waste occurs, and worse than waste; for a certain amount of energy must be expended to carry this overplus through the body; (2) The excess food may be digested and assimilated (metabolized) and what we call growth results. The body becomes bigger and heavier, and, if this growth be normal, as in the case of children and young people, all is well. (3) The excess food may be changed into fat, and more or less fat may be deposited in the tissues. Up to a certain point this is a good thing. The fat represents a storage of energy (potential energy) that may serve a good purpose on occasion; just as a bank deposit, representing money of which you have no need at the moment, may come to be useful, when your debtors do not come to time, and enable you to meet your obligations. But this deposition of fat may go to excess; and by creating layers of fat in the muscles, may so weaken them, that they can no longer work efficiently. For example, the heart is a muscle, and what is called fatty degeneration of the heart, always fatal, is merely the result of too much fat deposition in this muscle.

If too little food be taken, then, as long as expenditure of energy goes on and it has already been shown that an expenditure amounting to 1,680 calories, in the case of an adult of 156 pounds weight goes on in every 24 hours, even though the person lies quietly in bed the whole time, there must be a deficit at the end of each day, and the individual undergoes starvation. If he possesses a considerable store of surplus energy, as fat, this store will be drawn upon. The body will lose weight, but the loss is something that can be spared without serious harm. When this store of fat is used up,

energy can still be obtained, but it will now be derived from the actual body tissue and the body will waste away to the point of exhaustion and death. This is of course, the worst kind of cannibalism for the man is consuming, as food, the material of his own body. Death results when the weight of the body is reduced to two-fifths of its original weight (Chosat). This, of course, refers to death by simple starvation, and apart from all disease.

All foods provide energy. A substance taken by the mouth, which does not furnish energy, is not, in the true sense, a food. We do, as a matter of fact, take in many such substances with our food, chiefly for the purpose of sweetening it (saccharin) or of giving it a pleasant flavour (spices, etc.). One substance, which is not in the strict sense a food, we must have in considerable amount. I refer to water. Sixty-three per cent of the total weight of the human body consists of water. Practically all foods as prepared for the table, consist largely of water. This is especially the case with soups, stews, puddings, porridge, etc., and many market foodstuffs, which we do not think of as containing water, nevertheless contain large amounts of it. Thus, average beef contains 15 per cent; fresh fish about 30 to 40 per cent; bread, 33 per cent; potatoes, 76 per cent; cabbage, 90 per cent.

But water must be taken to a greater or less extent by itself, in addition to that which is incorporated with our ordinary table dishes. We must keep in mind that most of the waste products of life (chlorides, urea, uric acid, phosphates, etc.) are got rid of by the use of water as a solvent.

Fortunately, the consumption of water does not enter largely into the question of the cost of food, so that I need say nothing further about it than that we are not likely to use too much of it as a beverage, while most people use decidedly too little.

All foods, properly so called, may be divided into two classes:—

1st. Those which contain material capable of building up the tissues of the body (muscle, bone, cartilage, etc.) in addition to being able to furnish energy. To this class of foods the term *proteids* is applied.

2nd. Those foods which, practically, supply energy only. It is necessary on account of the way in which the body works in changing food into energy, to subdivide this class into two subclasses, known as *Fats and Carbohydrates.*

Fats and carbohydrates are capable, to some extent, of replacing each other without serious impairment of the bodily functions; but neither subclass can totally replace the other without disastrous results.

These three terms, proteids, fats, and carbohydrates, must be constantly borne in mind, if any useful application of scientific knowledge is to result. Some examples of typical foods of each class may be given to assist in memorizing the terms.

Proteids.—The white of egg, skim-milk cheese and gelatine are illustrations of food material essentially of proteid character. Among foods which do not altogether consist of proteids, but are chiefly valued because of their proteid content may be mentioned all kinds of meat and fish; gluten bread, condensed skim milk, and macaroni.

All proteids are not of equal value in nutrition, but although the differences are considerable, it would be entirely beyond the scope of this paper to enter into details.

What is of prime importence to be remembered is the fact that on an average, every ounce of proteid is capable of producing 116 calories of energy, when digested and assimilated as food (calculated from 1 gramme=4·1 calories). This number will be frequently made use of in what follows, and should be remembered.

Fats.—This term is quite generally understood, and must be taken to include all fats of whatever origin. For although small differences exist between the food values of fats derived from animal sources (butter, lard, tallow, etc.) and those of

vegetable origin (olive oil, cocoanut oil, cotton seed oil, etc.) these differences are so small as to be negligible for purposes of this study.

Every ounce of fat, properly digested in the body, produces 264 calories of energy, and this number must be fixed in the memory.

Carbohydrates.—This term includes the various starches (wheat, rice, potato, oatmeal, etc.) and also sugars (ordinary sugar, syrup, honey, etc.)

The energy value of carbohydrates is identical with that for proteids, namely 116 calories per ounce; but carbohydrates, unlike proteids, do not contain material for building up the framework of the body.

I have already pointed out that life processes demand exepnditure of energy and that, if these processes are to be continuous, there must be a continuous supply of energy, by means of food.

For a man of average weight, engaged in ordinary work largely sedentary during 10 hours of every day, it has been shown that a daily expenditure of energy measured as 2,500 calories is involved; while for a man engaged in arduous work (such as farming) 3,500 calories are needed.

For a woman, it has been established that approximately four-fifths of the above amounts of energy are expended.

But it is not enough to know the total energy as must be evident by considering that fats and carbohydrates while supplying large amounts of energy, do not supply the body-building elements. If the framework of the machine is not kept in repair, it cannot be expected to do its work no matter how much power is supplied to it. Indeed; the more energetically we insist on driving a machine, any of whose parts are out of adjustment, the sooner shall we wreck it altogether.

This phase of the matter has also been studied very carefully by physiologists; and perfectly definite results are on record. The most important generalization is that of Professor Voit, who is recognized as the highest authority upon this subject. According to Voit, the daily diet of a man engaged in work requiring an expenditure of 2,810 calories of energy, should be in the ratio:—

Proteids: Fats, Carbohydrates: = 4·162: 1·975: 17·637, and for a woman requiring 2,240 calories, the ratio should be:—

Proteids: Fat, Carbohydrates: =3·316: 1.587: 14·110.

These ratios represent parts by weight, and are intended to apply to the food of persons who must economize in expenditure to the lowest limit at which health can be maintained.

It will be noted that the amount of fat is in each case about one-ninth of the amount of carbohydrate. This is acknowledged to be undesirably low; and is suggested with a view to the utmost economy, fat being the most costly food constituent. The lower class of the German peasantry use a diet of the kind indicated. Among the wealthy classes of Germany, however, the ratio of fat to carbohydrate was found to be 1 to 3 or 4 instead of 1 to 9. I have already stated that while fats and carbohydrates cannot replace proteids in the diet, they may to a large extent, replace each other. Where utmost economy is necessary, of course, the fat component of the diet, as being the most costly, will be reduced to its lowest terms, and the carbohydrate correspondingly increased. There is a limit below which this cannot be done, if health is to be maintained, and the above quoted ratio fixes this limit. It is regrettable that food fat in palatable form, should be so costly. Wherever possible the fat should be increased, and the carbohydrate correspondingly decreased.

It is notoriously the case that the greater part of the fat in lamb and mutton chops, sirloin steak, and the best cuts of all kinds of meats, is not eaten, and is too often wasted. The butcher leaves this fat on the chop or steak, partly as evidence that the meat is derived from a well fatted carcass, and partly because he gets a better

price for it, when sold at the price of chops or steak, than he could secure by selling it simply as fat. The ordinary man has no appetite for the excess of beef or mutton fat supplied in the form of cooked steak or chop. Here is a distinct waste of valuable food material, a waste which amounts to millions of dollars every year. This excess of beef and mutton fat should be worked up into palatable form, a matter which could be easily accomplished by well known methods of manufacture.

This aspect of the matter is so very interesting that I am tempted to introduce some statistics, by way of illustration. The following represent actual dietaries upon which the individuals, representative of the classes to which they respectively belong, maintained a working vitality. They are quoted from Hammarsten's Physiological Chemistry, as translated by Mandel; and are not to be understood as other than selected instances of actually investigated cases, introduced for illustrative purposes. I have merely converted Hammarsten's statements, which are given in grammes, into ounces in order that they may be more intelligible to my readers.

Examples of the daily quantity of food in specific individuals and the calculated energy represented by this food.

Quantities in ounces Avoirdupois. *Energy* in calories.

	Description.	Proteids.	Fats.	Carbo-hydrates.	Calories.
1	Soldier during peace	4·197	1·411	18·659	2784
2	Soldier in light service	4·127	1·235	15·768	2424
3	Soldier in the field	5·150	1·623	17·778	2872
4	Labourer at work	4·586	1·411	19·400	2903
5	Labourer at rest	4·832	2·540	12·416	2458
6	Cabinet maker (40 years)	4·621	2·398	17·425	2835
7	Young physician	4·480	3·171	10·143	2502
8	Young physician	4·727	3·598	10·300	2476
9	Labourer	4·691	3·351	14·885	2902
10	English smith	6·208	2·505	23·492	3780
11	English pugilist	10·159	3·104	3·280	2189
12	Bavarian woodman	4·762	7·337	30·900	5589
13	Silesian labourer	2·822	0·564	19·471	2518
14	Seamstress in London	1·904	1·023	10·300	1688
15	Swedish labourer	4·727	2·787	17·108	3019
16	Japanese student	2·928	0·494	21·941	2779
17	Japanese shopman	1·940	0·212	13·898	1744
18	Eskimo (Krough)	9·947	1·443	1·792	2604
19	Bengali	1·834	0·907	16·649	2390

A little intelligent attention given to this record will be well repaid; and I would particularly ask you to note the following points.

Nos. 1, 2, 3. The soldier in the field receives a decidedly better ration than in peace, or on light service. The increase is most notable in proteid and fat; but whether in barracks or in the field his ration is adequate; and is practically that recommended by Voit for a man of about 150 to 160 pounds weight. The proportions of each constituent are approximately correct, with exception of the fat, which is distinctly too low. This is undoubtedly a matter of economy and cannot be scientifically justified.

Nos. 4 and 5. It should be understood that the weight of the body must be taken into account in all computations of a proper ration. I have not the body weight of the individual here reported. He has more fat when at rest than when at work, which is distinctly not as it should be. Probably when on holiday, he is able to indulge in butter to an unusual extent. His excess energy demanded by labour is derived from increased carbohydrates, the cheapest source of energy.

No. 6 is fairly well nourished.

Nos. 7 and 8. Professional work does not make such strenuous demands for expenditure of energy. It is usually better paid; hence the possibility of supplying a larger proportion of it by the consumption of relatively expensive fats.

No. 9. This labourer is better nourished than No. 4, although the energy furnished by his food is identical with that of No. 4. A much larger proportion of it is supplied by fat.

No. 10. It is evidently a big man, expending much energy. The proportion of fat in his diet is decidedly too small.

No. 11. The pugilist in training is putting on muscle. He is supplied with large excess proteid matter, and carbohydrates are kept down as much as possible. This is not a normal ration, but one suited to a special end.

No. 12. Is amply supplied with energy for very severe work. Such a ration could not be tolerated by any other than a strong man, very actively employed.

No. 13. Evidence of poverty is given by the reduction of fat in his ration.

No. 14. A clear case of under nutrition. One is reminded of the "Song of the Shirt."

No. 15. A good ration, for light work.

No. 16. Diet chiefly rice, and sadly lacking in fat.

No. 17. Emphatically under nourished. It must, however, be remembered that Nos. 16 and 17 are probably cases of very small men.

No. 18. Great excess of proteids as compared with the other food components. It must, however, be kept in mind that climatic and food conditions are not comparable in the case of the Eskimo, with those obtaining in temperate climes.

No. 19. As contrasted with No. 18, the difference between life in Hindustan and Greenland is very evident.

APPLICATION.

If what has been said is clearly apprehended, it remains but to emphasize the fact that the lowest satisfactory ration for the average man, engaged in ordinary work, must contain about 2,800 calories of energy, and for a woman about 2,240 calories; and that this amount of energy should be supplied by proteids, fat and carbohydrate food, in the ratio of 4·162 ounces, 1·975 ounces and 17·637 ounces, respectively, in the daily diet of man; and 3·316 ounces, 1·587 ounces and 14·110 ounces for women.

A better diet, for those who can afford it, results from an increase in the fat content, and a corresponding decrease in the carbohydrate content.

These are rather awkward numbers to bear in mind, and it is not necessary in actual life, that we should work so close to the theory. Especially is this the case when we remember that complete utilization of the food eaten, seldom or never occurs; nor can we expect every sample of any one kind of food to be strictly similar to every other. The average values of all ordinary food materials, stated as proteids fat and carbohydrates, have been very carefully determined. Full milk cheese, for example, as calculated from the examination of very numerous samples, contains 23 per cent proteids, 27 per cent fat and 4 per cent, carbohydrates; while skim-milk cheese contains 33·4 per cent proteids, 6·6 per cent fat, and 5 per cent carbohydrates, the difference in each case, being made up of mineral matters and water, which we do not recognize as food for our present purpose. But individual samples of cheese will vary from these averages by amounts that remain unknown to the consumer. The same thing is true of meats, fish, breads, and all other forms of food.

The individual variations must, for our purpose be left out of consideration in constructing a ration and we must agree to accept the best available averages as our guides. If we buy only honest and unadulterated food, we may feel reasonably sure that its energy equivalent will not depart very largely from the values given in the

following table. Remembering what has been said, it will be sufficient to take the following ratios, as defining the rations indicated.

Cheapest Satisfactory Daily Ration.

For man, of average weight (150-160 pounds):—
Proteids, 4·2 oz.; Fats, 2 oz.; Carbohydrates, 18 oz., energy equivalent=2,903 calories.
For woman of average weight:—
Proteids, 3·5 oz.; Fats, 1·6 oz.; Carbohydrates, 14 oz., energy equivalent=2,452 calories.

A Better Ration would be:

For men, proteids 4·2 oz.; Fats, 3oz.; Carbohydrates, 16 oz., energy equivalent=3,135 calories.
For women: Proteid, 3·5 oz.; Fats, 2 oz.; Carbohydrates, 15 oz., energy equivalent =2,674 calories.

If we know the proteid, fat and carbohydrate value of every market-food, we can, with a good degree of exactness calculate the amounts of the various foods needed to furnish any desired ration; and if in addition to this, we know the market prices of the different materials, we are able, by very simple calculations, to determine the cost of such ration; and to vary its cost according to changes in market prices, without changing the food value of the ration, that is its energy producing value, which is the main consideration in the case of most of us.

A few examples will suffice to indicate the process.

Each one pound avoirdupois of the following foods, contain the stated number of ounces of proteids, fats and carbohydrates respectively.

The numbers given have been re-calculated from the percentage numbers tabulated by Kœnig in his great work "Chemie der Menschlichen Nahrungs und Genussmittel" 4th edition.

In most cases they are averages from great numbers of analytical determinations; and although individual specimens of any particular food may vary considerably, from these averages, we may confidently accept them as representing the true food content, when more than one or two purchases are taken into account.

Each 1 lb. avoirdupois of the food named contains.	Proteids ounces.	Fats ounces.	Carbo-hydrates ounces.	Cost of 1 lb. Ottawa, June, 1917.	Remarks.
Beef—Brisket	3·056	1·996	0	·16	Best.
" flank	2·768	4·128	0	16 to 12·5	1st & 2nd cuts.
" loin	2·928	3·120	0	·35	
" sirloin	3·024	2·832	0	·35	
" tenderloin	2·496	3·904	0	·75	
" ribs	2·736	4·080	0	·28	
" roundsteak, best	3·264	1·600	0	·32	
" roundsteak, second	2·816	3·808	0	·25	
" foreshank	3·280	1·440	0	·10	
" hindshank	3·248	1·520	0	·10	
" tongue	2·784	2·880	0	·25	
" heart	3·088	2·128	0	·12·5	
" liver	3·216	0·880	0	·15	
" kidney	2·624	0·848	0	·18	
Veal leg	3·296	0·944	0	·22	Whole leg.

Each 1 lb. avoirdupois of the food named contains.	Proteids ounces.	Fats ounces.	Carbo-hydrates ounces.	Cost of 1 lb. Ottawa, June, 1917.	Remarks.
Veal cutlets	3·120	1·632	0	·32	
Mutton – average	2·736	0·928	0	25 to 30	
Lamb – average	2·848	3·616	0	·15, 25, 30	
Pork – fat	2·320	5·968	0	·34	
Pork lean	3·248	1·088	0	·32	
Pork ham	2·960	2·832	0	·34	
Blood – various sources	2·896	0·032	0		None.
Blood from fatted beef	3·344	0·160	0		None.
Rabbit – whole	3·344	0·160	0	·10	
Hen – flesh	3·408	0·728	0	·25	
Salmon	3·157	1·718	0	·30	
Fresh Herring	2·578	1·355	0	·10	
Mackerel	3·090	1·293	0	·18	
Cod	2·675	0·048	0	·12 ·5 & ·16	
Haddock	2·709	0·042	0	·10	
Dried Codfish	13·046	0·118	0	·10	
Dried & salted codfish	11·579	0·395	0	·10	
Smoked Haddie	4·331	0·058	0	·15	
Smoked & salted herring	5·882	2·518	0	·10	Red herring.
Sardines	4·544	1·291	0	·32	
Oysters	1·581	0·304	0		None.
Caviare	4·694	2·237	0		None.
Lobster	3·054	0·156	0	·40	
Beef, dried (pemmican)	11·120	0·934	0		None.
Beef, corned	3·469	0·778	0	·18	
Sausages, frankfurters	2·002	6·258	0		None.
Sausages, Blood	1·739	1·628	3.274	·12·5	Containing cereals.
Eggs, Hens	2·068	1·938	0	·26	
Milk, whole milk	0·546	0·606	0.784	·04	
" skimmed	0·422	0·139	0.758	·02	
" condensed, no sugar	1·737	1·827	2.234	·20	
" condensed sugared	1·290	1·533	8.450	·20	Ameriean.
" condensed sugared	1·673	1·611	8.163	·20	American and foreign.
Milk skim – sugared	2·034	0·421	9.037		
" powder, whole milk	3·694	3·702	6.782		
" powder skimmed	4·930	0·279	8.549		
Cream	0·659	3·810	0·627	·25	
Butter	0·122	13·392	0·080	·42	
Oleomargarine	0·158	14·014	0		None.
Cheese—Cheddar	4·362	5·080	0·538		
" American	4·118	5·482	0·390	·30	
" average quality	4·194	4·729	0·542	·30	
" skim milk	5·694	1·992	0·675		None.
" Roquefort	4·235	5·300	0·412		"
Buttermilk	0·626	0·163	0·678	·02	
Infants' Foods, Ridge's	1·392	0·221	13·046	1·00	
Infants' Foods, Mellin's	1·250	0·046	13·213	1·20	
Infants' Foods, Neave's	2·112	0·272	12·494	0·50	
Wheat Flour – Fine	1·709	0·180	11·950	·09	
Wheat Flour – coarse	1·856	0·254	11·742	·08	
Wheat Flour – whole	1·509	0·150	12·147	·07	
Rye Flour	1·529	0·230	11·824	·07	
Oatmeal	2·219	0·989	10·730	·07	
Cornmeal	1·539	0·402	11·472	·07	
Buckwheat flour	1·325	0·238	11·933	·08	
Pea meal	4·115	0·285	9·149		None.
Macaroni	1·741	0·099	12·088	·10	
Rice flour	1·183	0·110	12·652	·10	
Corn starch	0·192	0·002	13·618	·13	
Sago "	0·346	0	13·085	·16	
Tapioca starch	0·118	0·026	11·498	·16	
Potato starch	0·141	0·008	12·909		None.
Bread wheat, fine	1·090	0·086	9·248	·07	
Bread wheat, coarse	1·150	0·146	8·158	·06	
Bread Graham	1·296	0·115	8·533	·06	
Wheat biscuits	1·586	0·408	12·464	·20	
Rye bread	1·029	0·182	8·069	·07	
Oatmeal cakes	1·373	1·664	10·669		None.
Potatoes	0·318	0·024	3·338	·055	
Artichokes	0·302	0·029	2·624		None.
Sweet potatoes	0·251	0·080	3·861		"

Each 1 lb. avoirdupois of the food named contains.	Proteids ounces.	Fats ounces	Carbo-hydrates ounces.	Cost of 1 lb. Ottawa, June, 1917.	Remarks.
Beets – Mangold	0·202	0·021	1·381		None.
Beets – sugar	0·198	0·016	2·427	·20	
Carrots	0·189	0·046	1·450		
Turnips—Swedes	0·222	0·029	1·179		None.
Melons	0·134	0·021	1·016	·04	
Cucumbers	0·174	0·018	0·354	·10	
Pumpkins	0·176	0·021	1·024		None.
Tomatoes	0·154	0·030	0·638	·20	
Green peas	1·054	0·083	1·989		None.
Green beans	0·435	0·022	1·056		?
Asparagus	0·312	0·022	0·384	·02	
Cabbage	0·288	0·032	0·606	·07	
Cauliflower	0·397	0·054	0·728	·50	
Spinach	0·594	0·008	0·578	·07	
Lettuce	0·226	0·050	0·350	·075	
Onions	0·256	0·024	1·661	·08	
Canned peas	0·578	0·134	1·344	·10	
Baked beans	1·144	0·510	2·822	·15 to ·20	None.
Sugar corn	0·458	0·200	2·973	·12	None.
Succotash	0·565	0·139	2·808		
Sauerkraut	0·200	0·086	0·616		None.
Mushrooms	0·781	0·032	0·571	·90	
Apples	0·048	0	1·416		None.
Pears	0·056	0	1·488		"
Plums	0·162	0	2·477		
Grapes	0·162	0	2·421		
Oranges	0·173	0	0·808	·07	
Dried apples	0·227	0·310	7·726	·13	
Dried apricots	0·494	0	4·138	·18	
Raisins	0·403	0·094	10·843	·15	
Dried figs	0·573	0·203	8·342	·10 to ·20	
Sugar	0	0	15·531	·09	
Corn syrup	0	0	12·866	·19	
Honey	0·227	0	12·032	·15	
Black pepper	1·955	1·243	6·019	·40	
White pepper	1·877	1·053	8·704	·45	
Coffee roasted	2·261	2·216	9·572	·40	
Tea	3·861	1·318	?	·30 to ·60	
Cocoa	3·523	4·536	2·899	·40 to ·50	
Peanut butter	4·392	7·608	2·102	·23	
Rolled Oats	1·893	1·058	11·416	·09	
Rolled Wheat	1·403	0·304	12·355	·10	
Shredded Wheat	1·845	0·136	12·242	·20	
"Force"	1·622	0·242	12·301	·24	
Peas dried	4·344	0·350	8·632	·08	

This table might be almost indefinitely extended, and I could wish it to include every available form in which our markets offer food material. Even as here published it will serve to enable us to apply to the cost of food the principles which I have attempted to present in what has been written. The prices quoted are, of course, subject to frequent change; and economical buying involves a constant watching of the local market.

It is desired to ascertain the lowest cost of satisfactory nutrition in case of a family comprising, let us say, three men, of about average weight (150 to 160 lbs.) and two women.

Referring to page 10, it will be seen that this involves the furnishing of:—

For the men:	Proteids 12·6;	Fats 6·0 oz.;	Carbohydrates 54 oz.
For the women:	" 7·0	" 3·2	" 42
Total	19·6	9·2	96

Total energy required is 15,838 calories. (From proteids x 116; fats x 264; carbohydrates x 116.)

From the table on pp. 11-12, we find that the necessary proteids may be furnished in many different ways. In choosing certain foods as sources of proteids we incidentally introduce fats, or fats and carbohydrates at the same time; and as a balanced ration is demanded, a certain amount of patience, ingenuity and intelligence is involved. The matter is, however, really very simple; and the thought which must be given to the solution of the problem, should make it all the more interesting to the intelligent housewife.

I here present a few of the numerous solutions of this problem.

Food Materials.	Quantity. Lbs.	Proteids. Oz.	Fats. Oz.	Carbohydrates. Oz.	Cost.
Oatmeal	2	4·438	1·978	21·460	14
Graham bread	4	5·184	0·460	34·132	24
Milk-whole	5	2·730	3·030	3·920	20
Sugar	1	0	0	15·531	9
Beef (brisket)	3	9·168	5·988	0	48
Potatoes	2	0·636	0·048	6·676	11
Corn starch	1	0 192	0·002	13·618	13
Total	18	22·348	11 506	95·337	$1 39

This ration shows the following departures from the calculated amounts:—

Proteids	2·748 oz.	excess.	
Fats	2·306	"	"
Carbohydrates	0·663	"	deficiency.

The energy value is:

Proteids	22.348 × 116 =	2592·368	calories.	
Fats	11·506 × 264 =	3037·584	"	
Carbohydrates	95·337 × 116 =	11059·092	"	
Total		16689·044	"	
Calculated		15838·000	"	
Excess		851·044	"	

On the whole this is a sufficiently close approximation to theoretical requirements, and since a little waste is almost unavoidable in cooking and serving, it may be regarded as satisfactory.

The cost is $1.39 for 5 people per day.

Here is another attempt at solution:

Food Materials.	Quantity. Lbs.	Proteids. Oz.	Fats. Oz.	Carbohydrates. Oz.	Cost.
Ham	1	2·960	2·832	0	34
Eggs	1	2·068	1·938	0	26
Bread (fine)	4	4·360	0·344	36·992	28
Butter	½	0·061	6·696	0·040	21
Milk	3	1·638	1·818	2·352	12
Codfish	3	8·025	0·144	0	45
Sugar	1½	0	0	23·297	13½
Corn starch	1	0·192	0·002	13·618	13
Total	15	19·304	13·774	96·299	$1.92½

This ration shows the following departures from calculated amounts:—

Proteids	0·296	deficiency.
Fats	4·574	excess.
Carbohydrates	0·298	"
Energy value	17046	calories.
Calculated	15838	"
Excess	1208	"

The cost of this daily ration is considerably more than in the first case, due to introduction of more fats. The total energy value is, however, but slightly enhanced.

It may be worth while to illustrate by a third calculation, in which we shall endeavour to secure the necessary amounts of food at the lowest possible cost.

Food Materials.	Quantity. Lbs.	Proteids. Oz.	Fats. Oz.	Carbohydrates. Oz.	Cost.
Beef, shank	3	9·840	4·320	0	30
Bread, coarse	4	4·600	0·584	32·632	24
Milk, whole	4	2·184	2·424	3·136	16
Sugar	2	0	0	31·062	18
Oatmeal	1½	3·329	1·483	16·095	10½
Corn starch	1	0·192	0·002	13·618	13
Total	15½	20·145	8·813	96·543	$1.11½

This ration indicated a slight excess in proteids compensating a slight deficiency in fats.

The energy value is	15994	calories.
Theoretical requirements	15938	"
Excess	56	"

The total cost is only $1.11½.

It is scarcely necessary to say, that want of care in purchasing material might cause a ration, having no greater food value than the above, to cost two, three or four times the above amounts.

It should be noted that, while the food values assumed in the above rations, are sufficient to maintain energy in persons of average weight, and engaged in work which makes no severe demands, they must be regarded as minimum values, and make no allowance, for unusual fatigue, for waste in use of the food, or for that variety of choice in food materials which is absolutely necessary to prevent loss of appetite. It will be especially apparent that the relation of fats to carbohydrates is kept as low as possible, for the sake of reducing cost.

Statistics prove that the German peasantry are, in large part, fed upon a ration of this character; and I have no doubt that if other countries had accumulated similar, carefully obtained statistical information, it would have proved much the same thing in their cases.

The prolonged use of a diet so relatively poor in fat, results in physiological disturbances which ultimately break down the system and induce disease. The comprehensive word which describes this condition is "indigestion" or "dyspepsia" and its expression in face and form and temper is so apparent in the experience of every one as to need no emphasis here. The proteid content of the above rations is also too low; and I may quote the following from Professor Rubner, an authority in the field of nutrition study: "The diet of the upper classes is the only one which provides the pleasures of the table; it is rich in proteid and fat; it is not voluminous, does not

overburden the stomach, tends less to obesity than any other diet, keeps the body even of a lazy man in good condition, and does not overwork the digestive functions. The less well-to-do, reduce, of course, the amount of meat, using in its place bread and potatoes."

I have already referred to the desirability of increasing the relative proportion of fat in our diet, and have recommended the ratio, Proteids: Fats, Carbohydrates: 4·2: 3: 16 as a decided improvement.

I shall illustrate a ration for our supposed family of 5 persons on this basis:—

3 men require	Proteids	12.6 :	Fats 9 :	Carbohydrates 48 oz.
2 women require	Proteids	7.0 :	Fats 4 :	Carbohydrates 30 oz.
Totals		19.6	13	78

This may be furnished by:—

		Proteids.	Fat.	Carbohydrates.	Cost.
	lb.	oz.	oz.	oz.	cts.
Rolled Oats	1	1.893	1.058	11.416	9
Milk	3	1.638	1.818	2.352	12
Ham	$\frac{1}{3}$	1 480	1.416	0	17
Bread	3	3.270	0.258	27.774	21
Eggs	1	2.068	1.938	0	26
Round steak	2	6.528	3.200	0	64
Sugar	$\frac{1}{3}$	0	0	7.766	$4\frac{1}{2}$
Corn starch	$\frac{1}{16}$	0 096	0.001	6.809	$6\frac{1}{2}$
Lamb	1	2.848	3.616	0	25
	$12\frac{1}{2}$	19.821	13.305	56.087	$1.85

Energy furnished	14637 calories
Energy required	14754 calories
Difference	117 deficiency

I do not pretend to recommend in detail, any particular ration. The reader who has carefully studied what has been said, will have no difficulty in calculating very various rations from the data given; and it should furnish an interesting exercise to any one seeking household economy, to select, such combinations as will satisfy nature's demands, and at the same time form palatable dishes.

It is to be remembered that cooking has much to do with the appetizing character of food, and with its digestibility, consequently with its usefulness to the organism.

Many of the food materials given in the table are not practically available in the form in which they are purchased. This is the case with flour, lard, and others. These are rather to be regarded as constituents of food than as food itself. The housewife who makes tea-cakes, from flour, lard, etc., can easily calculate the food value of her product, as well as its cost, if she weigh in the ingredients, and also weigh the finished article. The food value of a complex cake if properly baked, is exactly the sum of the food value of the ingredients.

Several matters of importance in this connection, can only be mentioned here. To deal fully with them, would too greatly extend this essay; and would distract attention from the single purpose for which this has been written; namely the importance of giving attention to the nutrient value of our food; and the outlining of a simple method of calculating this value, and of correlating it to the actual cost of available food materials.

Briefly, the matters referred to are the following:—

1. Many foods and food materials are on the market in patented or proprietary forms. As a rule, these particular foods are very desirable; frequently they are the choicest forms in which the special article can be purchased. But they are relatively costly, and, regarded from the simple standpoint of nutrient value, they cannot be recommended to housewives whose main object in buying is to secure maximum food value at lowest cost. And it is mainly for this class that I have written.

2. I have not specially considered a dietary for children or for growing youth. The subject is too large to be dealt with usefully within my limits. As a rule, it may be accepted that a somewhat larger proportion of proteid food is required where the body tissues are increasing; that is, where growth is taking place; or in the case of convalescents, where waste is being made good.

3. The mineral matters of food have not been taken into account. Needless to say that these are of equal importance with nutrition as I have defined it. They are ordinarily present in our foods, and we take them incidentally and of necessity when we use natural food materials. In some cases, as where rice has been polished, or where flour has been ground from wheat after removal of the outer coating of the grain (bran) we are using an impoverished food material, and of course we must suffer, unless we supply the material which is lacking, by some equivalent food stuff. For this reason, true economy demands that we should prefer *whole wheat bread,* to the white bread so commonly in use.

4. An examination of the table herein will show that vegetables and fruit possess an apparently negligible value as nutrients. This is not, however, to be interpreted as rendering them useless in the dietary. We are so constituted as to require a certain proportion of non-nutritive material in our diet; if normal digestion is to proceed. In other words, our food must possess a certain bulk, as well as a definite nutrient value. Vegetables supply this bulk, and at the same time introduce certain small amounts of various acids and other components necessary to the enjoyment of our meals, and consequently to health.

5. Condiments, such as salt, pepper and spice, while possessing no nutrient values worth taking into consideration when we regard the minute amounts consumed, are necessary in order to give flavour to our food, and thus to stimulate appetite and the various secretions of the digestive system, through whose agency metabolism takes place.

6. Vitamines, are always present in natural foods, and food materials.

They greatly influence the efficiency of food, as regards growth, and the prevention and cure of disease, although in amount so small as to have escaped attention until quite recently. Any one desirous, of further information regarding Vitamines, may consult Public Health Report, Washington, Vol. 31 pp. 364 to 370; or a paper in the American Journal of Pharmacy for September 1916, p. 410.

In a recent address to the American section of the Society of Chemical Industry, Professor Graham Lusk of Cornell University recommended that, as far as possible, all foods should be purchased with a knowledge of their calorific and nutritive values, and that packed foods should be labelled with this information. I fear that such action would injuriously affect the sale of many high priced and extensively advertised forms of food.

BULLETIN No. 378—FERTILIZERS FOR 1917.

OTTAWA, July 25, 1917.

SIR,—I beg to hand you our usual annual report upon the inspection of Fertilizers as offered on Canadian markets. Three hundred and forty-nine (349) samples were procured by our inspectors during March, April and May, and these have been submitted to analysis with the following results:—

Samples found	to meet their guarantee	322
"	to meet their guarantee, by compensating values	13
"	to meet guarantee as printed on the tag	2
"	doubtful	1
"	low in ammonia	4
"	low in phosphoric acid	6
"	low in both ammonia and phosphoric acid	1
	Total	349

In the case of two samples (Nos. 55952 and 55976) the values are fully up to the guaranteed values as printed upon the accompanying tag; but these printed values are not in accordance with those registered in Departmental files. The purchaser sustains no loss, in such case; but the manufacturer has violated section 8 of the Fertilizers Act, which decrees as below:—

Section 8. "If a manufacturer elects to change the formula or composition of any fertilizer for which a registration number has been granted, he shall notify the Minister to that effect, and shall apply for a new registration number to designate the new or altered fertilizer, and the former registration number shall be cancelled, and shall not be reissued."

One sample (No. 55949) I have described as doubtful, because although it meets the guarantee as later filed at the Department, it was offered for sale and supplied to our inspector, before being granted a registration number. It is fair to state that no sale was effected, the sample not being charged for. Fertilizers must be registered, and the tag must state the specific registration number before they can be legally offered for sale (Sec. 5).

With few exceptions, the discrepancies between guaranteed values, and the values as found on analysis, are quite small; and I am justified in saying that in general, manufacturers of these articles are supplying goods which meet statutory requirements.

BULLETIN No. 379—BLACK PEPPER.

OTTAWA, July 3rd, 1917.

SIR,—I beg to hand you a report upon the examination of 345 samples, sold as Black Pepper.

These samples were purchased by our inspectors in January, February and March of this year and represent the article as supplied to the public throughout Canada.

Pepper, and especially Black Pepper, continues to be the most generally adulterated spice offered on our markets; a fact which may perhaps be due to its extensive

sale, which apparently makes it profitable to mix it with such various worthless articles as pepper shells and the dirt which adheres to these; ground olive stones, cocoanut shell and other similar sclerenchymatous cellular matters; and starches. The following synopsis gives the results of systematic inspection since 1876.

Bulletin.	Year of Inspection.	Kind.	Percentage of adulteration.
	1876 and 1877	White and Black.	83.0
	1878	"	70.0
	1879	"	50.0
	1880	"	43.0
	1881	"	66.6
	1882	"	69.0
	1883	"	65.0
	1884	"	71.0
	1885	"	57.3
	1886	"	51.3
	1888	"	69.0
20	1890	"	52.0
	1891	"	58.5
	1894	"	46.8
	1896	"	27.4
	1899	"	20.0
	1900	"	22.7
95	1904	"	55 4
103	1905	"	42.0
106	1905	Black.	45.9
106	1905	White.	31.7
165	1908	Black.	24.3
165	1908	White.	21.9
203	1910	Black.	17.9
203	1910	White.	17.1
248	1913	Black.	17.0
250	1913	White.	19.0
314	1915	White.	4.1
379	1917	Black.	13.9

While this record shows a great and a fairly continuous improvement in the character of the article since the earlier inspections, it leaves much still to be desired.

I am informed by certain grinders that it is not uncommon for them to receive orders from retailers to supply an article which can be profitably sold at a certain fixed price. The filling of such an order may necessitate adjustment of the amount of worthless material (filler) corresponding to the then prevailing price of actual pepper; and ground pepper has been known to be sold at a lower price than the unground article was then commanding.

The public should understand that in purchasing an adulterated article at a lower cost than that of the genuine, they are not effecting a real economy. The added material has no spice value, and it is certain to be present in such amount as to afford not only an offset to any apparent reduction in price, but an accompanying profit to the grinder.

The results of the present inspection may be stated thus:

Found to meet legal requirements	258	samples.
Found to be doubtful in character	30	"
Found to be legally adulterated	48	"
Found to be collected in error	9	"
Total	345	"

Although a limit of 7 per cent, for total ash in pepper is not legally established in Canada, this limit is generally accepted by other countries, and it is desirable that it should be made legal in this country also. Where pepper tissues only have been found, with total ash in excess of 7 per cent. I have in the meantime, judged the sample as doubtful in quality.

BULLETIN No. 380—HEADACHE POWDERS.

OTTAWA, July 6, 1917.

SIR,—I beg to hand you a report dealing with the examination of 102 samples sold as Headache Powders. These samples were procured by our inspectors in October and November of last year.

They may be classified as follows; on the basis of the active ingredient contained in them:—

Acetanilide (antifebrin)	81	samples
Phenacetin	13	"
Both acetanilide and phenacetin	2	"
Aspirin (acetosalicylic acid)	6	"
Total	102	"

Acetanilide continues to be the main drug in evidence. This is doubtless due to its relative cheapness, and to the fact that its potency makes it effective in smaller amount than either phenacetin or aspirin.

The respective doses prescribed by the British Pharmacopeia for these drugs are as below (Edn. 1914):—

Acetanilide	2 to 5 grains
Phenacetin	5 to 15 "
Phenazone	5 to 15 "
Aspirin	5 to 15 "

The medical advisers of this Department have fixed the following limits for the drugs named, having reference to interpretation of section 7 (c) of the Proprietary or Patent Medicine Act.

Acetanilide	2 grains
Phenacetin	5 "
Phenazone	5 "

This has regard to the presence of these drugs, without declaration on the package, one drug only being present in any case.

Where two sheduled drugs are present, each being in amount decidedly below permitted maximum, we interpret the above section of the Act as permitting the second drug in such amount only as may be considered complementary to that in which the first is present. For example, when one grain acetanilide is present 2·5 grains phenacetin may also be present; but no more.

Aspirin (acetosalicylic acid) is not specifically named in the Patent Medicine Act.

The results of analysis may be thus summarized:

Samples which meet legal requirements without declaration of drug	54
" which declare drug present	31
" Adjudged as doubtful	2
" Adjudged as adulterated	15
Total	102

One sample classified as *doubtful,* shows a decided excess of acetanilide in one powder, but another powder is within legal limits. The discrepancy may be due to carelessness in weighing out the material on the part of the manufacturer; and it is open to question whether or not such irregularity should be permitted to escape penalty.

The second sample so classified, declares the presence of *Antikamnia* which is a mixture of acetanilide with bicarbonate of soda. It is questionable whether or not the use of the term antikamnia may be accepted as tantamount to a statement that acetanilide is the active drug.

Adulteration consists in the presence of more than the permissable amount of the active drug, without declaration of the presence of such drug on the label.

We have made previous inspections of Headache Powders, as below:—

Bulletin No. 113—January, 1906	30 samples
Acetanilide found in	28 samples
Bulletin No. 230—Dec, 1911	150 samples
Acetanilide found in	118 samples
Bulletin No. 268—Sept, 1913	171 samples
Acetanilide found in	139 samples

BULLETIN No. 381—WHITE PEPPER.

OTTAWA, August 13, 1917.

SIR,—I beg to hand you a report upon the results of examination of 207 samples, sold as White Pepper. These samples were purchased by our inspectors in April, May and June of the present year.

The following is a summary of results:—

Found to be genuine	187	samples
Judged as doubtful, for reasons given below	4	"
Found adulterated under the Act	16	"
Total	207	

Two samples (5624 and 7341) contain wheat starch, in amount not exceeding about 5 per cent, and may be passed on the assumption that this foreign matter is present accidentally, and not with fraudulent intent.

No. 6873 contains excess of stone cells (Schlerenchyma), apparently, to some extent of foreign origin. These may have been added purposefully, but the sample has been granted the advantage of the doubt, as their specific nature has not been made out.

No. 77709 has an abnormally high ash for a white pepper. Legal limits for ash in pepper have not yet been established. Adulteration consists in the addition of foreign matter, thus reducing and injuriously affecting the quality and strength; and being an inferior or cheaper substance. Section 3, (a) and (b) of the Act.

Our last report upon White Pepper is contained in Bulletin No. 314 (May, 1915), and showed adulteration amounting to 4·1 per cent of a total of 387 samples. The present report shows 8·1 per cent. adulterated.

BULLETIN No. 382—LINIMENT OF CAMPHOR (Linimentum Camphoræ).

OTTAWA, August 16, 1917.

SIR,—I beg to hand you a report upon 94 samples of Liniment of Camphor, purchased by our inspectors in April, May and June of this year.

Orders for this collection were issued in March last, and 106 samples were returned;

The British Pharmacopœia (Edn. 1914) requires Liniment of Camphor to contain 20 per cent of camphor, dissolved in Olive Oil.

In India, and in the Eastern, African, Australesian and North American Divisions of the Empire, Arachis (pea-nut) or Sesame Oil, but no other oil or fat may be employed instead of Olive Oil.

The United States Pharmacopœia, Ninth revision (1916), prescribes the same percentage amount of Camphor, but directs Cotton Seed Oil to be used as the solvent.

Fifty-three (53) of the samples now reported are made with Cotton Seed Oil; and if judged by the formula of the British Pharmacopœia, are technically adulterated on this account. Nineteen (19) of these samples are genuine, so far as the content of camphor is concerned; and if judged by the formula of the United States Pharmacopœia, are strictly correct. There would appear to be no good reason for regarding cotton seed oil as in any way inferior to Olive Oil, in the preparation of this liniment, and I have judged these samples as genuine.

The following summary presents the result of our work:—

Samples collected by mistake.	12	
Samples liniment of camphor	94	
Total	106	
Liniment of Camphor.		
Made with Olive Oil	41	samples.
Made with Cotton Seed Oil	53	"
Total	94	"
Containing above 20 per cent. camphor	40	samples.
Containing above 18 per cent. camphor	15	"
Containing above 15 per cent. camphor	18	"
Containing less than 15 per cent. camphor	21	"
Total	94	"

The camphor content is the most important feature of this Liniment. Owing to the volatility of this component, and for the purpose of allowing reasonable variation in manufacture, the U. S. P. specifically permits the camphor content to vary from 19·5 to 20·5 per cent. The B. P. prescribes no limits of the kind.

Bearing in mind that this is our first systematic examination of the article, it may be permitted to accept samples containing at least 18 per cent of camphor as satisfactory; and perhaps those containing at least 15 per cent as doubtful; such judgments, however, are not to be regarded as precedents, for future decisions. If this suggestion be accepted the samples, as regards camphor content, may be classified thus:

Genuine, both as regards camphor content, and solvent	36
Genuine as regards camphor content	19
Doubtful	18
Adulterated	21
Total	94

As already noted, those samples which contain less than 18 per cent of camphor, (39 in number, or 41 per cent, of the total collection) are undoubtedly to be regarded as adulterated; although for this time passed as "doubtful" where as much as 15 per cent of camphor is present: and do not furnish the purchaser with a satisfactory article, or the physician with an effective remedy. Nine of them contain less than 10 per cent of camphor; and several of them considerably less than this amount.

I have on previous occasions found cause to remark upon the carelessness, or worse, exhibited by the retail drug trade in Canada; (See Bulletins 175,225, 265, 315,339,342, 344); and it is sufficiently evident that the Adulteration Act applying to the inspection of Drugs as well as Foods, must be enforced as vigorously in regard to the first named class of articles as to the latter. Whether or not the fact that most of our Apothecary shops are more truly described as Candy, Tobacco and nick-nack shops, has anything to do with the lack of attention given to quality of drugs proper, must be left an open question; but it is suggestive, and cannot be allowed to pass without remark.

BULLETIN No. 383—PACKAGED BREAKFAST FOODS.

OTTAWA, October 5, 1917.

SIR,—I beg to hand you a report upon 275 samples of so-called Breakfast Foods purchased by our inspectors throughout Canada in April, May and June of this year. The collection comprises apparently some fifty-one different sorts or brands of material.

The work of analysis was done in somewhat greater detail at Ottawa than at the sub-laboratories; for which reason I have arranged the results in two tables (I and II) the first showing results as obtained at the sub-laboratories upon 149 samples; the second giving results of work upon 126 samples at Ottawa.

It is necessary to note that the net weight of contents of the package has reference to the food content. Several packages contained such foreign material as crockery, and in these instances the weight of the article was deducted. Thus sample 75773 was guaranteed to contain 65 ounces as packed. It actually contained only 53·9 ounces of food, and a plate weighing 11·3 ounces. No. 68392 contained a saucer weighing 9·95 ounces, and No. 75729 a plate weighing 7·76 ounces.

The popularity of the foods now under discussion is undoubtedly due to four factors. (1) Attractive and wide-spread advertising, (2) A growing tendency to save time in the preparation of the meal, (3) the guarantee of cleanliness furnished by the manner of packaging, (4) the attractive flavour possessed by most of these foods.

It is further to be noted that all the foods in question are nutritious and appetizing; and where the question of cost, in relation to food value, is not of importance, they are to be highly commended.

It cannot, however, be denied that the cost of many of these foods, when considered in relation to the amount of nutriment contained in them, makes many of them decidedly expensive, and rather to be classed as luxuries than as staples, so far as regards that large class of consumers who are compelled by circumstances to consider expenditure.

The value of food, regarded from the standpoint of nutritive quality, is measured in terms of the calorie, which may be understood to express the amount of energy

derivable on digestion of food. A man of average weight engaged in comparatively light work, requires about 2,800 to 3,000 calories daily, in order to maintain health. If engaged in hard work, he must have more than this amount; say, about 3,500 calories. It must further be understood that no single food, (except perhaps milk in certain cases) supplies this energy in such a way that it could be made the sole diet of a healthy person.

In Table III, the results of this investigation are presented so that the reader may perceive the relation which exists between actual food value and cost. In the last column of this table is given the price, in cents, of that quantity of each food, which can furnish 1,000 calories of energy. The price used in making this calculation is the average price paid by our inspectors for the samples purchased irrespective of the place where purchased. Inasmuch as the cost price varies considerably in different localities, this fact must be taken into consideration where comparison of one food with another is instituted. Thus it will be seen, by reference to Tables I and II, that Kellogg's Corn Flakes have been purchased at prices varying from 12 to 27 cents per pound; Cream of Wheat at prices ranging from 11 to 15 cents per pound; Force, at prices varying from 16 to 38 cents per pound; Grape Nuts, at prices from 14 to 19 cents; and so on, of the others. It is difficult to understand why the local prices of standard foods should vary so greatly; but the fact remains. Freight charges doubtless affect the local price; and when the varying weight of the contents of packages, nominally of the same size, is taken into account, and calculated into cost per pound, this greatly affects the actual cost in many cases. Thus we find the net contents of packages of Kellogg's Corn Flakes to vary from 8 to 13·25 ounces; Force, from 7·5 ounces to 12·75 ounces; Post Toasties, from 12 ounces to 17·14 ounces, etc. Many other brands have a practically constant weight. Thus, in 15 samples of Cream of Wheat, the extreme weights are 27·25 ounces and 29·17 ounces; in 20 samples of Grape Nuts, the extremes are 12·75 ounces and 16·92 ounces; the great majority of the samples weighing close upon 15 ounces.

It is greatly to be desired that in all packaged foods the manufacturer should be required to state the actual weight of food contained in the package.

For the reasons above given, it must be understood that the subjoined cost prices for each 1,000 calories of energy obtainable from the special food named, may not correctly represent the cost of the food upon the Canadian market, considered as a whole. The prices given, do, however, correctly represent the cost of the food as indicated by the prices actually paid by our inspectors, for the particular samples analyzed.

1000 CALORIES OF ENERGY DERIVED FROM:-

	Cents.		Cents
Robin Hood Oats, large size costs	4.40	Malta Vita	8.59
Purity Oats, small	4.49	oman Meal, small size	8.75
Tillson's Oats	4 94	Kellogg's Rice Flakes	9.46
Quaker Oats, large size	5 00	Kellogg's Krumbles	9.50
Robin Hood Oats, small size	5.01	Grape Nuts	9.85
Brodies Oats	5.41	Quaker Farina	10.10
Quaker Oats, small size	5.57	Gusto	10.12
Roman Meal, large size	6.24	Roman Meal Nuggets	10.55
Malt Breakfast Food	6.43	Kellogg's Corn Flakes	10.64
Wheat Kernels	6.52	Hecker's Cream Farina	10.73
Kellogg's Bran	6.59	Shredded Wheat	10.75
Post Tavern Special	6.80	Kellogg's Wheat Biscuits	10.87
Pettijohns Breakfast Food	6.91	Wheatena	10.96
Quaker Corn Flakes	7.08	Good Health Breakfast Food	11.49
Cream of wheat	7.12	Uncle Sam's Health Food	12.94
Krinkle Corn Flakes	7.13	Kellogg's Wheat Flakes	13.18
Quaker Pearl Hominy	7.15	Force	13.63
Robin Hood Porridge Wheat	7.72	Quaker Puffed Wheat	20.14
Post Toasties	7.74	Quaker Puffed Rice	21.93
Kellogg's Corn Flakes, Dominion	8.29		

Another consequence of the varying amount of material in these packages is that where only one or two samples of the article have come into our hands, the results found cannot be held with certainty to describe the average character of the article.

Variations in weight and cost price of these foods are more noticeable than variations in the character of the food itself. Careful study of Tables I and II will bear out the conclusion that, so far as food value is concerned, the material is fairly constant in character. Thus to take a few examples, the following may be quoted:

Name of Food.	Number of samples.	Caloric value for 1000 grams. Dry.			Extreme Variation.
		Mean.	Maximum.	Minimum.	
Kellogg's Corn Flakes	17	4011	4064	3902	162
Cream of Wheat	16	4106	4125	3909	216
Force	18	4001	4026	3937	89
Grape Nuts	21	4000	4035	3971	64
Kellogg's Krumbles	13	3938	3967	3908	59
Post Toasties	18	3995	4123	3860	263
Quaker Puffed Wheat	16	4039	4118	3987	131
Shredded Wheat	14	4014	4029	3915	164

The calorie (large calorie) is that amount of energy which, when considered as heat, would suffice to raise the temperature of 1 litre of water through 1 degree Centigrade. It is not however important or necessary that the ordinary reader should bear this fact in mind. It is enough to regard the calorie as an arbitrary unit of measurement for energy (the power to perform work), just as the yard is an arbitrary unit of measurement for distance, or the pound for weight. The value of the term, for purposes such as the present, is entirely comparative. If a man needs 3,000 calories of energy per day, he must be furnished with food of such kind and in such quantity as will yield him 3,000 calories, if he is to maintain health.

Determination of the absolute calorific value of any form of food is carried out by actual combustion of a known weight of the food under circumstances which permit of the heat produced being accurately measured. The instrument used (Calorimeter) in these determinations is so constructed that the total available heat energy is produced. In other words, combustion is complete.

The digestion effected by the human organism is seldom, or never, so complete as this. Rubner has calculated that at least 8 per cent of our food, on a mixed diet, passes through the body undigested, or incompletely digested. (Hammersten's Physiological Chemistry, Translation by Mandel, p. 585). It follows that in calculating the energy available from a given diet, the calorific values as determined by the Calorimeter must be reduced by 8 per cent if we would know the actual human energy derivable from such diet.

For purposes like the present it is necessary to refer the various elements of food to a limited number of classes and to ascertain, for each class, a factor which shall, as closely as possible indicate the calorific value of unit weight of this class. It is convenient for this reason, to group together such food constituents as casein, albumen, gluten, myosin, legumin, etc., as proteids, and to use the same factor in calculating their calorific value. This can only be an approximation to actual fact, although a pretty close approximation; and quite sufficiently accurate to form a useful guide in ascertaining food values.

In the same way, all forms of fat are grouped, and an average factor employed in calculating their calorific values; while the various starches and sugars are classified together as Carbohydrates, and a common factor used.

Rubner, already quoted, used the following factors:—

For Proteids	4.1
" Fats	9.3
" Carbohydrates	4.1

These numbers were derived from experiments with dogs fed on meat, starch, sugar, etc.,; and more recent work has demonstrated that Rubner's factors do not allow for so much loss in digestion as has been found to occur with men living on an ordinary mixed diet.

Sherman (Chemistry of Food and Nutrition, p. 128) uses the factors 4, 9 and 4, for protein, fat and carbohydrates respectively; and it is quite probable that these factors more nearly represent the true energy values, when we regard human digestion. In this report I have however retained Rubner's factors, for the reason that they have been extensively used in work already published by this, and by other laboratories. Furthermore, they do not greatly differ from Sherman's factors; and anyone wishing to compare results by the latter may multiply the given calorie value by the factor 0·983 for proteids and carbohydrates; and 0·968 for fats.

In calculating carbohydrate values I have omitted "Crude Fibre." This term applies to matters insoluble in boiling sulphuric acid (1·25 per cent strength) or in boiling caustic soda (1·25 p.c.). However the facts of availability as food, for such material, may be in the case of the Ruminantia, it is inconceivable that crude fibre can possess any food value for man. The amount of crude fibre in most of these breakfast foods is so small that the inclusion of crude fibre with the digestible carbohydrates would be of trifling moment, but for the fact that a small number of these foods contain added fibre to such amount as would give them an undeservedly high apparent food value were it reckoned as starch or sugar, which are actually digestible.

Comparison of Brands as reported in Bulletin 330 (1915) and Bulletin 383 (1917):

	Number of samples.	Calories per gram as sold.	Cost (cents) per 1000 calories.
"Kellogg's Corn Flakes"			
Bulletin 330	4	3.612	
" 383	17	3.721	10.64
"Krinkle Corn Flakes"			
Bulletin 330	1	3.790	
" 383	8	3.705	7.13
"Cream of Wheat"			
Bulletin 330	2	3.674	
" 383	16	3.694	7.12
"Force"			
Bulletin 330	1	3.675	
" 383	18	3.712	13.63
"Grape Nuts"			
Bulletin 330	3	3.711	
" 383	21	3.796	9.85
"Gusto"			
Bulletin 330	1	3.583	
" 383	6	3.693	10.12
"Hecker's Farina"			
Bulletin 330	1	3.716	
" 383	2	3.689	10.73
"Kellogg's Krumbles"			
Bulletin 330	1	3.634	
" 383	13	3.706	9.50

"Kellogg's Wheat Biscuits"

	Number of samples.	Calories per gram as sold.	Cost (cents) per 1000 calories.
Bulletin 330	1	3.496	.....
" 383	4	3.638	10.87

"Malt Breakfast Food"

Bulletin 330	1	3.669	.....
" 383	5	3.763	6.43

"Pettijohn's Breakfast Food"

Bulletin 330	1	3.508	.....
" 383	7	3.643	6.91

"Post Toasties"

Bulletin 330	1	3.700	.....
" 383	18	3.693	7.74

"Quaker Oats"

Bulletin 330	1	3.816	.....
" 383	3	3.955	5.00

"Quaker Puffed Rice"

Bulletin 330	1	3.683	.....
" 383	13	3.721	21.93

"Quaker Puffed Wheat"

Bulletin 330	2	3.754	.....
" 383	16	3.715	20.14

"Robin Hood Porridge Oats"

Bulletin 330	1	3.842	.....
" 383	4	3.955	5.01

"Roman Meal"

Bulletin 330	4	3.490	.....
" 383	5	3.520	8.75

"Shredded Wheat"

Bulletin 330	5	3.566	.....
" 383	14	3.685	10.75

In Table IV a comparison is made between the food value as determined in 1915 and this year in such brands of Breakfast Foods as came under examination in both inspections. That for 1915 is published as Bulletin No. 330. It is unfortunate that no determination of the weight of food in the packages were made in 1915, for which reason it is impossible to institute a comparison of the cost per calorie for the years named.

BULLETIN No. 384—MIDDLINGS (Shorts.)

OTTAWA, October 11, 1917.

SIR,—I have the honour to submit herewith a report upon 203 samples, purchased by our inspectors as Middlings or Shorts in April, May and June of this year.

Departmental regulations require this Feed to contain at least 15 per cent protein and 4 per cent fat; with not more than 8 per cent of crude fibre, and to be free from noxious weed-seeds. (Order in Council dated May 1st, 1911, published as Circular G, 968).

One hundred and seventy-eight (178) samples of this collection meet the above named requirements, the results of analysis being interpreted in accordance with section 15 of the Feeding Stuffs Act which provides that "a deficiency of one per cent of the protein or fat, or an excess of two per cent of fibre claimed to be contained in the feeding stuff, shall not be considered as evidence of fraudulent intent, if the total value of the feeding stuff in nutritive materials is substantially equivalent to the guaranteed statement made by the manufacturer or agent."

Eight (8) samples must be judged as adulterated under the Act, for the following reasons:

LOW PROTEIN AND FAT.

	Deficiency in protein.	Deficiency in fat.
No. 69784	0.41	0.58
" 7411	1.00	0.56
" 5613	1.50	0.03
" 52633	1.35	0.12
" 55981	1.23	0.80

LOW PROTEIN ONLY.

	Deficiency.
No. 77729	1.28
" 75744	1.89

LOW PROTEIN AND EXCESS FIBRE.

	Deficiency in protein.	Excess of fibre.
No. 77028	1.75	3.40

Ten (10) samples contain notable amounts of vital weed-seeds. This feature constitutes adulteration under G. 968.

It is, however, felt to be reasonable that a maximum limit, above which noxious weed-seeds shall constitute adulteration in feeds, should be legalized it is practically impossible, in certain classes of feeds, notably bran, chop and registered feeds, which may contain various forms of mill-offal, to prevent absolutely the entrance of these seeds. Moreover, while it may be very necessary to preclude the presence of weed-seeds in seed grain, it is not so absolutely necessary to do this with cattle feeds, since the digestive processes through which the seeds necessarily pass, result in destroying their vitality more or less.

This question has been considered in my report of May 20, 1913 (see Bulletin No. 254) and a recommendation to the effect that more than 25 seeds per pound of the feed, should constitute adulteration.

A much narrower limit than this might be justified for middlings (shorts) and feed flour, since these classes of feeds are necessarily ground to a high degree of fineness, and the presence of large numbers of vital seeds could only occur through carelessness in milling, or through intentional addition of material other than middlings or feed flour.

In Bulletin No. 350 I have discussed the advisability of recognizing a low grade flour, largely sold for feeding purposes, as distinct from shorts or middlings. It is mainly characterized by possessing a low fibre content and a higher starch content than ordinary middlings, and is usually whiter in colour. Although its nutritive value may be no greater, and is in some cases even less than that of middlings, it generally commands a higher price, probably because of its lighter colour, which is mistakenly held to indicate superiority. Five samples herein reported belong to the suggested class of feed flours; and four of them are low in proteid or fat value if judged as middlings. I have recommended that they be allowed to pass, as having been sold by mistake for another class of feed. No. 60680 is evidently a chop feed, and No.

71027 is linseed meal. In these cases I have recommended that the samples be permitted to pass as supplied in error.

Four other samples (55984, 55985, 75737 and 75743) are passed as very nearly meeting our standards.

BULLETIN No. 385—TABLE SALT.

OTTAWA, October 23, 1917.

SIR,—I beg to hand you a report upon 198 samples of Salt as refined for table use. The samples in question were obtained by our inspectors in April, May and June of this year.

This article has been examined and reported on three previous occasions under the Adulteration Act. The first report, published as Bulletin No. 128, in 1906 dealt with 87 samples, was written by my predecessor in office. It contains the following sentences:—

"The percentage of chloride of sodium contained in them varies from 93 to 98, with corresponding differences as regards the quantities of moisture and impurities present. It is probably inadmissible to call the latter adulterations, the limits of variability for salt not having been yet established in Canada. In the United States a standard was adopted on June 26, 1906 by circular No. 19 from the office of the Secretary of Agriculture, which reads as follows:—

"Table salt, dairy salt, is fine grained crystalline salt, containing on a water free basis, not more than one and four-tenths (1·4) per cent of calcium sulphate ($CaSO_4$), nor more than five-tenths (0·5) per cent of calcium and magnesium chlorides ($CaCl_2$) (and $MgCl_2$) nor more than one-tenth (0·1) per cent of matters insoluble in water."

It is not necessary to recalculate the results given in the table and state them on a dry basis in order to see that a very large proportion of the samples described would not come up to the United States standard. Taking the figures as they stand in the table there are at least one-half of the samples which would not do so. It is enough for the present to call attention to this fact in order that manufacturers or furnishers may aim at supplying an article of a higher degree of purity. On the other hand it is satisfactory to note that many of the samples of Canadian origin fulfil the requirements of the United States Department of Agriculture.

Among the samples examined there are six which contain foreign substances insoluble in water, and which have apparently been added to prevent the particles of salt from caking together. It does not appear that this constitutes adulteration, for the Act provides that the usual definitions shall not apply, "if any matter or ingredient not injurious to health has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce in a fit state for carriage or consumption, and not fraudulently to increase the bulk weight or measure of the food or drug, or to conceal the inferior quality thereof." Nevertheless it would seem to be necessary that these brands should each, on selling, be labelled as a mixture."

Subsequent examination of 273 samples (Bulletin No. 220, December, 1910) showed that 78 per cent of the collection met the above standard for Salt, as adopted by the Department of Agriculture, Washington; and a still later inspection of 139 samples in 1913 (Bulletin No. 270) justified the following remarks:—

"None of the samples can be regarded as in any way objectionable, still less as harmful, for the purposes of table salt.

At the same time, they vary in quality through a considerable range, as regards their freedom from other substances than chloride of sodium, which may be regarded as the essential and characteristic constituent of salt.

I think it not unreasonable to require that a purified salt, for table use, should be practically free from other chlorides than sodium chloride; and should contain sulphates in amount less than corresponding to 0·75 per cent of sulphuric acid (SO_3).

The only sulphate usually present in salt is calcium sulphate; and 0·75 per cent, SO_3 corresponds to about 1·28 per cent of calcium sulphate.

On this basis, 24 samples contain somewhat higher sulphates than should be found in refined salt.

Thirty samples show excessive amounts (above 0·1 per cent) of insoluble matter. In all cases this is of harmless character, and appears to be purposely added in order to reduce the hygroscopicity of the salt, and thus, to prevent caking. As I pointed out in Bulletin No. 220, the fact of such addition should be noted on the label."

The present report goes to show that table salt, as found in Canada, is a very satisfactory article. In the great majority of cases it is furnished without intentional additions, and those in cases in which from 1 to 2 per cent of non-hygroscopic matters (magnesium or calcium phosphate or carbonate) have been added to prevent caking the fact of such addition is usually announced on the label, or by the use of a distinctive brand name. Pure salt is, of course, chloride of sodium, and sodium chloride is actually present as follows:—

Above	99.5 per cent in	10 samples.
"	99.0 " "	84 "
"	98.5 " "	65 "
"	98.0 " "	25 "
	Total	184 "
Below 98 per cent in		14 "
	Total	198 "

With exception of two samples, those included in the class containing less than 98 per cent of sodium chloride are sold under distinctive names.

BULLETIN No. 386—CASCARA SAGRADA.

December 10, 1917.

Sir,—Owing to the fact that I have received many complaints, from physicians and others during recent years, regarding the preparations of cascara sagrada which are found in commerce, it has been considered desirable to make an examination of these, and particularly of the liquid extract, and the aromatic syrup. Both of these are pharmacopœal preparations, and if the official directions for their manufacture were conscientiously carried out they should exhibit at least an approximation to uniformity of character. The results of analysis herein presented will show that this is far from being the case; and there can be no doubt that many samples contain very little genuine extractive of cascara.

Several samples have been sold under names which are not recognized by any pharmacopeia. Where such samples bear a registration number, they conform to the requirements of the Proprietary or Patent Medicines Act. Otherwise they are sold in contravention of this Act.

The analytical work has been done, as is usual, in this laboratory and in the sub-laboratories at Halifax, Winnipeg, and Vancouver. Owing to the special nature of the subject, investigatory work was entrusted to Mr. Westman and Mr. Rowat, and their report being necessarily of a highly technical character, it is impossible to present it otherwise than in extenso and to do justice to the great amount of labour which they have bestowed upon the problem. For this reason I submit their report in detail; and I believe that it will be read with interest by physicians and by manufacturers as well as by analytical chemists, and by the public.

The data furnished by it will, it is hoped, make possible such specifications and standards for preparations of cascara sagrada, as shall enable us to check these, and control them in the interest of the medical profession and the public.

In all, 162 samples have been analyzed as follows:—

At Ottawa	76	samples.
" Halifax	28	"
" Winnipeg	32	"
" Vancouver	26	"
Total	162	"

This laboratory is specially indebted to Dr. J. M. Francis, Chief Chemist of the Parke, Davis Company, Detroit, for assistance in this investigation.

I beg to recommend publication of this report as Bulletin No. 386.

December 6, 1917.

Dr. A. McGILL,
Chief Analyst,
Ottawa, Ont.

DEAR SIR,—We beg herewith to submit a report to you dealing with the analysis of seventy-six samples collected as liquid extract of cascara sagrada. We have included such data in our tables as was available from the work of other laboratories. As our report is the result of more exhaustive work than was undertaken at the branch laboratories and covers a much larger number of samples, it is found that the inclusion of this data in our tables does not greatly change our averages.

As this was the first time that a collection of this nature had been examined by these laboratories, it was found necessary not only to appeal very largely to original articles dealing with the subject, but to carry on certain investigatory work of a somewhat original nature in order to devise a means of evaluating such extracts, either relatively, or absolutely, from the viewpoint of chemical analysis.

Before approaching work of this kind a knowledge of the requirements of various pharmacopœias is essential as a constant guide. This information has been collected and is outlined below.

PREPARATION AS DEFINED IN B. P. 1914 AND CODEX 1911.

Cascara sagrada is defined to be "The dried bark of Rhamnus purshiana D.C. and collected at least one year before being used."

The official preparations as defined in this edition, as far as liquids or fluids are concerned, are,

1. *Liquid Extract of Cascara Sagrada.*

Cascara Sagrada in No. 20 powder	1,000 grammes.
Alcohol (90%)	250 cc.
Distilled water sufficient to produce	1,000 cc.

Instructions are given to exhaust the cascara sagrada with the distilled water by the percolation process. This process is given in B. P. Appendix, 1914, p. 526, as follows: "Moisten the solid materials with the prescribed quantity of menstrum, set aside for four hours, in a well-closed vessel, pack in a percolator, add sufficient of the menstrum to saturate the materials and leave a layer of liquid above. Macerate for 24 hours; then allow percolation to proceed slowly until the percolate measures about three-fourths of the volume required for the finished tincture. Press the marc, mix the expressed liquid with the percolate and add sufficient of the menstrum to produce the required volume. Clarify by subsidence or filtration, if necessary."

Following this the percolate is evaporated to 600cc and the alcohol, previously mixed with sufficient distilled water to produce the required volume is added. Methods of percolation are quoted in detail for the reason that they differ and this difference might be the basis of slight variations in genuine liquid extracts.

2. *Aromatic syrup of cascara. B.P. 1914, p. 377.*

Although the original intention was not to examine extracts of this nature, a considerable number were collected by our inspectors and since they form a large percentage of cascara preparations it seemed best to make some examination of their value. A large number of samples were sold simply as "Cascara Sagrada." Some of these were liquid extracts and some were aromatic. Being sold as above under a name that is not descriptive or definite in any sense it is to be implied that they do not claim to conform with any pharmacopœial standards. Analysis in many cases shows the correctness of this implication. It is to be noted at the same time that they are not sold as registered patent medicines.

The aromatic syrup of cascara B.P. contains:—

Liquid Extract of Cascara Sagrada	400 cc.
Tincture of orange	100 cc.
Alcohol (90%)	50 cc.
Cinnamon water	150 cc.
Syrup sufficient to produce	1,000 cc.

The syrup referred to is stipulated to be made from refined sugar and water. 1,000 grammes of sugar made up to a weight of 1,500 grammes. This gives a specific gravity of 1·330.

The B. P. Codex, 1911, mentions seventeen extracts and compounds in which cascara may be employed. Four of these are compound tablets or pills. The rest are liquid, fluid, or aromatic extracts or mixtures. They may contain in general any combination of aromatic oils, tinctures, licorice, glycerin, alcohol, alkalis, ammonia or chloroform water.

In order to destroy the natural bitter taste of the cascara, lime, magnesia, potassium hydroxide, ammonia and zinc oxide have been used with some success during percolation. Penschuck Chem. Abst, 1915, states, that for the purpose of debittering, sodium and ammonium salts are better than calcium or magnesium on account of the solubility of the products formed. Chloroform water may be added to prevent active fermentation. The use of alkalis follows from the incompatibility of extracts of cascara with acids or strong solutions of mineral salts.

PREPARATION OF CASCARA SAGRADA DEFINED IN U. S. P.

Cascara sagrada is defined as "The dried bark of the trunk and branches of *Rhamnus purshiana* De Candolle (fam. Rhamnaceae)."

Four official preparations are mentioned. These are, extract, the powdered extract, the fluid extract, and the aromatic fluid extract. The last two alone will be described here.

1. Fluid extract of cascara sagrada U. S. P., 1910:—

Cascara Sagrada in No. 40 powder	1,000 grammes.
Alcohol	250 cc.

It is stated that the percolation should be carried out in the following manner. Type process D., p. 176, U. S. P., 1910. "To 1,000 grammes of the ground drug add 5,000cc. of boiling water, mix thoroughly, allow it to macerate in a covered container in a warm place for two hours. Then transfer the moist drug to a tinned or enamelled percolator, and allow percolation to proceed, gradually adding boiling water until the drug is exhausted. Evaporate the percolate on a water bath to the volume specified and when cold add the alcohol directed and mix thoroughly." From 1,000 grammes of drug 1,000cc. of fluid extract are made by the method quoted.

2. Aromatic Fluid extract of cascara (official), U.S.P., 1910, p. 180, contains the following:—

Cascara Sagrada No. 40 powder	1,000 grammes.
Magnesium oxide	125 "
Pure Extract of Glycyrrhiza (licorice)	40 "
Glycerin	200 ccs.
Alcohol	250 "
Benzosulphimide	1 gramme.
Oil of cinnamon	0·2 ccs.
Oil of anise	2·5 "
Oil of coriander	0·1 "
Methyl salicylate	0·2 "
Boiling water sufficient to produce	1,000 "

The cascara sagrada is thoroughly mixed with the magnesium oxide and moistened with 2,000cc. of boiling water. It is allowed to stand for two hours with stirring and then placed in a percolator. Boiling water is poured on the drug until exhausted and the percolate evaporated to 500cc. and while yet warm, the licorice is dissolved in it. When cold the glycerin is added and then the alcohol in which the benzosulphimide and oils have been dissolved. Finally sufficient water to make the required volume of 1,000cc. is added.

The French Pharmacopœia adds nothing new to the above and the literature bearing on the analytical constants to be expected from the analysis of such mixtures is very scanty, and covers at most the examination of a very few samples, none of which were either prepared or sold in this country.

Cascara sagrada (sacred bark) is the bark of a Western American tree, *Rhamnus purshiana*. It was discovered in 1806. In 1877 it was raised from the status of an Indian preparation to one used by the medical profession by Dr. J. H. Bundy. It was in 1878 that the Parke Davis Company, Detroit, Mich., first placed a fluid extract on the market. The next year it was introduced into Europe by the British Medical Association. In 1911 it was estimated that one million pounds of this bark were being used annually. Up to the present no cultivation of the tree has been carried beyond the experimental stage. Any increase in the price has been sufficient inducement for the more extensive gathering of the natural bark.

It is impossible to review here all the work that has been done on the botanical and chemical nature of this bark and the group to which it belongs. Only a few general and indispensable points will be considered and a few of the better references

given. The complexity of the chemistry involved in a study of the active constituents and bitter principles of such drugs has been so great that their actual identification has not yet been established. Prescott, Amer. Jour. of Pharm., vol. 51, 1879, p. 165, working on the bark isolated, certain resins, tannic acid, oxalic and malic acid, certain oils, and wax. The presence of emodin in this bark is noted by Limousin Jour. de Pharm. et de Chim., vol. 6, 1885, p. 80, and Jowett, Proc. Amer. Pharm. Assoc., vol. 52, 1904, p. 288, isolated certain isomers of emodin as well as arachidic acid and a hydrolytic enzyme. Mossler. Pharm. Post, 1913, vol. 46, p. 313, dealing with emodin-bearing drugs, rhubarb, cascara, senna and aloes obtains crystals, after suitable extraction, which are seen to be specific for the first three under polarized light. The chemistry of cascara is inseparable from that of other drugs of the same class, namely, the emodin-bearing drugs aloes, rhubarb, and senna. As these are at any time likely, from their properties to be in admixture the analyst must as far as he is able apply qualitative tests for their distinction when dealing with any one of them unless he knows absolutely the previous history of the sample. Besides those mentioned we have *Rhamnus frangula* (buckthorn) which is more like *Rhamnus purshiana* (cascara) than any of the others..

This class of drugs may be best tested for by the Bornträger reaction for emodin. The nature of this test and other colour tests will be given later. Neither the bitter nor the total laxative properties of these drugs are due to this constituent. Emodin is a trioxymethylanthraquinone. It is a hydrolytic decomposition product of glucosides in the bark. Although the active constituents of these drugs are not known, it may be said that they are not alkaloids.

The genuine *Rhamnus purshiana* is most likely to be confused with the members of the same family, *Rhamnus frangula* and *Rhamnus californica. Rhamnus frangula* is imported into this country from Europe. *Rhamnus californica* grows in greater abundance in the southwestern States than it does in the north. There are sufficient points of difference to render their identification fairly easy under the microscope or by colour test and extracts. No legitimate excuse could thus be made for their indiscriminate use. Other barks have been found present in shipments or *Rhamnus purshiana.* Among them are to be mentioned Western Wild Cherry, and *Cornus nutelli* (Western Flowering Dogwood). A large volume of work has accumulated with reference to the barks themselves and their microscopy. The best bibliography of this work up to 1914 is given by Johnson and Hindman, Amer. Jour. Pharm., 1914, p. 387. Here a history of the drug and 139 articles of reference on *Rhamnus purshiana* may be found.

Considerable work has been done from the viewpoint of the analyst who is called upon to distinguish cascara in admixture. Emodin may be detected in the presence of phenolphthalein, as is shown by Warren, Amer. Jour. Pharm., Oct., 1914, p. 444. Tichborne, British Year Book of Pharm., 1901, p. 439, gives an account of his examination of 29 samples of liquid extract of cascara; 9 were adulterated. This opinion was based on the drying or non-drying qualities of the extract and the amount of reducing sugars present.

ANALYTICAL DETERMINATIONS AND NATURE OF WORK REPORTED.

After due consideration of the possible data which might be derived from work on these samples, it was decided that the basis of our report should be made to include the following determinations. The headings which are to follow will be discussed one by one and reasons set forth for their adoption. Wherever possible analytical results will be discussed from the viewpoint of standards. Tables showing ranges and averages will be given along with the method of procedure in outline.

1. SPECIFIC GRAVITY.

By this determination alone a close line may be drawn between those samples which are likely to prove to be aromatic and those likely to be found liquid or fluid extracts of cascara. Determinations were made directly at room temperature (20 deg. C.) by means of a set of hydrometers. The following table deals with 130 samples and bears no relation to what these samples were sold as, but is based on what their examination proved them to be. Three tables forming a natural division of the whole number are given:—

TABLE 1.

1. Aromatic Extracts of Cascara.		2. Preparations not "official" sold under various labels. Some sold as Fluid Ex. Cas. Sag.		3. Fluid Extract of Cascara.	
Range of sp. gr.	Samples in range.	Range of sp. gr.	Samples in range.	Range of sp. gr.	Samples in range.
1.00 to 1.10	None.	1.00 to 1.10	5	1.00 to 1.03	0
		1.10 to 1.15	0	1.03 to 1 04	1
1.10 to 1.15	3	1.15 to 1 20	11	1.04 to 1.05	3
1.15 to 1.20	8	1.20 to 1.25	2	1.05 to 1.06	12
1.20 to 1.25	3	1.25 to 1.30	0	1.06 to 1.07	29
1.25 to 1 30	4	1.30 to 1.35	0	1.07 to 1.08	40
	Total 18	1.35 to 1 40	1	1.08 to 1.09	4
			Total 19	1.09 to 1.10	4
					Total 93

Group one contains licorice, glycerin and aromatics.

Group two contains trade preparations, glycerinated cascaras without licorice or aromatics.

Group three contains preparations presumed to be Fluid Extracts of Cascara.

It is to be noted here that Squire's Companion to B.P. p. 410, 1916 gives the specific gravity of Liquid Extracts as 1·060. It would appear from our work that a suitable range would be from 1·05 to 1·08. Samples below this range proved to be diluted extracts by other determinations, and samples above this range contain more solids than it is normally possible to extract by official methods of percolation.

2. ALCOHOL.

It has been calculated that B.P. Fluid Etracts of Cascara Sagrada should contain 25·5 per cent ethyl alcohol by volume. This is based on the ground that the 250cc. of 90 per cent alcohol required is equivalent to 225cc. of absolute alcohol.

By similar methods, and by reference to requirements it may be shown that:—

B.P. Syr. Cas. Sag. should contain 13·5% alcohol by volume.
U.S.P. Fl. Cas. Sag. should contain 24% alcohol by volume.
U.S.P. Aromatic Cas. Sag. should contain 24% alcohol by volume.

From an inspection of the above and from consideration of tables it may be seen to what extent these conditions have been met with by samples under consideration. These tables refer to the same classification as was given under previous heading.

TABLE 2.

Group 1.		Group 3.	
Range of alcohol.	Samples.	Range of alcohol.	Samples.
0 to 1%	4	3 to 4%	1
1 " 2	5	10 " 11	1
2 " 3	2	13 " 14	1
3 " 4	1	14 " 15	5
4 " 5	0	15 " 16	2
5 " 6	1	16 " 17	16
6 " 9	0	17 " 18	14
9 " 10	1	18 " 19	2
10 " 14	0	19 " 20	13
14 " 15	2	20 " 21	11
15 " 16	1	21 " 22	5
16 " 19	0	22 " 23	8
19 " 20	1	23 " 24	9
Total	18	24 " 25	1
		25 " 26	1
Group 2.		26 " 27	1
0 to 1%	3	27 " 28	1
1 " 2	8	28 " 29	2
2 " 11	0	29 " 30	1
11 " 12	2	30 " 31	1
12 " 13	0	Total	96
13 " 14	2		
14 " 17	0		
17 " 18	1		
18 " 21	0		
21 " 22	2		
Total	18		

Very few samples comply strictly with the alcohol requirements. The presence of the required amounts of both alcohol and glycerin in Aromatic samples is very rare and the majority of fluid extracts range a few per cent low. The extracts of lower alcoholic strength give an increased sedimentation on standing. Glycerin when present in sufficient quantity gives a permanent solution of solids which would otherwise settle out on dilution with water.

3. TOTAL SOLIDS.

TABLE 3.

Group 1. Total Solids.	Samples.	Group 2. Total Solids.	Samples.	Group 3. Total Solids.	Samples.
40 to 50%	5	15 to 20%	1	Below 18%	6
50 " 60	4	20 " 25	3	18 to 20	2
60 " 70	3	25 " 35	1	20 " 25	27
70 " 80	4	35 " 45	0	25 " 30	45
80 " 90	2	45 " 50	2	30 " 35	16
		50 " 60	2		
		60 " 70	8		
		70 " 95	2		
	Total 18		Total 19		Total 96

Here a marked difference is shown between the aromatic and near aromatic, and the liquid extracts. This is due to the presence of licorice, glycerine or sugar. Perhaps the total solids show better than any other single determination the inconstancy of the composition of aromatic extracts and trade preparations. Squire's would allow

a range of from 17 to 27 per cent solids W/V. This is a very wide range yet it does not seem wide enough to contain all the samples sold as Liquid Extracts. Parke, Davis and Co. in a private communication supplied us with data relative to the possibility of obtaining a uniform extract from cascara bark. Out of 24 lots of this drug, working on a commercial basis, the extractive matter never once fell below 18·8 per cent and exceeded 22 per cent in only one instance. This particular sample ran up to 26·6 per cent. They were using the official U.S.P. method of percolation. From such evidence it would appear that there is no valid reason why the total solids of a genuine extract of cascara made according to any official preparation should not remain uniform, from time to time. It seems quite evident then that the range for extracts sold as official liquid or fluid extracts might reasonably be established temporarily as ranging from 17 to 27 per cent. It may be seen from the general table or from group 3 of this section that a large number sold at present would be cut out under such a ruling.

The problem of setting standards for total solids is made more complicated when it is considered that even while using official methods of percolation results obtained may differ. Our own work shows this. By the method of extraction employed by the B.P. we obtained on two samples of genuine cascara bark an extract whose total solid content ran 21·79 and 21·03 per cent. While working on this same bark and using the U.S.P. method of percolation we obtained 30·50 and 31·48 per cent solids. In order to wash out the last traces of colour we used 1800cc. of water in portions of 75cc. (boiling). The official U.S.P. method requires the washing to be sufficient to give a clear filtrate coming through. It does not specify the amount or the portions in which this amount is to be used. We were working on 50 gram samples of No. 40 powdered bark. These factors that are not mentioned are important in obtaining uniform results. It must then be admitted that such methods as are given in pharmacopoeias are of little value as they now stand as a basis for standards. Much greater detail is necessary before uniformity should be looked for in the products of different firms. Such results as quoted above from Parke, Davis & Co., simply go to show that they work in a uniform manner. Others using different detail might easily obtain uniform results several per cent higher, and yet would be using the official method.

The exposure of a few drops of cascara extract on a porcelain plate serves as a very simple and useful test of the nature of any cascara extract. A genuine liquid extract will dry up in a short time to a hard varnish. If the extract contains licorice or glycerin it will not dry even after long exposure over days or weeks. A diluted extract of cascara will not readily dry out to a hard glassy varnish. It forms a sticky semi-crystalline mass, which does not lose this property for several days. This may be due to the fact that on dilution the resins will precipitate out first, and if they are already partly gone the remaining solution is unable to form the same natural varnish that the genuine extract does. There would also seem to be a definite relation between this drying property and the reducing sugar content. A normal liquid extract of cascara contains not less than 5·75 per cent of reducing sugars calculated as glucose. If the sugar content is above this limit it will quickly dry to a glassy varnish. If the reducing sugar content is below this it will not quickly dry but remains a sticky mass on the plate. All aromatic extracts studied were found to be non-drying due to their glycerin content.

The total solids were determined as W/V. 10cc. were dried in platinum at 110 deg. C., to a constant weight. Those samples containing glycerin make results of this nature hard to control to very narrow limits, for the reason that at this temperature there is some loss of the glycerin in the steam.

4. SOLIDS PRECIPITATED ON DILUTION.

An aromatic extract containing glycerin or licorice will keep in solution all its solids on dilution with water. On the other hand a liquid extract whose solids are

retained in solution by virtue of its alcohol content will when diluted give a measurable precipitation. If the solution has the proper content of alcohol, but is lacking in cascara bark extractive, this deficiency is made evident by the small precipitation on dilution. It may be noted here that concentrated extract of cascara is insoluble to a large measure in 90 per cent alcohol. As this alcohol is diluted these solids go into solution but on excessive dilution where the alcohol content drops to 10 per cent or lower a marked settling out of the solids occurs. The dilution was made by dropping 5cc. of the extract into 95cc. of water and filtering off the solids formed.

TABLE 4.

Group 1.—No precipitation on dilution observed in any sample.

Group 2.—No precipitation on dilution observed in 12 samples. Two samples showed some precipitation up to 2 per cent.

Group 3.—No precipitation on dilution observed in one sample only.

This sample contained only 3 per cent alcohol and no precipitation was to be expected.

Percentage W/V of Solids precipitated on dilution.	Samples.
0·50 to 1·0 per cent	5
1·00 " 1·50 "	11
1·50 " 2·00 "	13
2·00 " 2·50 "	12
2·50 " 3·00 "	5
3·00 " 3·50 "	4
3·50 " 4·50 "	2
Total	52

It is evident here that the extreme limits for apparently genuine extracts would be from 1·00 per cent to 4·50 per cent. It might be more advisable to place a lower limit on at 1·5 per cent.

5. REDUCING SUGARS.

Reducing sugars, as glucose, were estimated on 76 samples. There is a variation shown and it is evident that there is a normal content for genuine liquid extracts of cascara. This runs from 5·25 to 7·75 per cent. Aromatic extracts are always much lower and run from 1 to 3 per cent. The amount of sugar formed in a normal liquid extract by acid hydrolysis does not exceed 3 per cent. If more than this amount is present it is evidence of added sucrose.

TABLE 5.

Group 1.		Group 2.		Group 3.	
Reducing Sugar.	Samples.	Reducing Sugar.	Samples.	Reducing Sugar.	Samples.
0 to 1%	1	0 to 1%	0	0 to 4%	2
1 " 2	3	1 " 2	2	4 " 5	7
2 " 3	3	2 " 3	2	5 " 6	6
3 " 4	1	3 " 4	3	6 " 7	17
	Total 8	4 " 5	1	7 " 8	10
Less than 5%	8	5 " 6	0	8 " 9	7
Greater than 5%	0	6 " 7	2	9 " 10	1
		7 " 8	1	10 " 11	4
		8 " 9	2		Total 54
		9 " 10	2		
			Total 15		
		Less than 5%	8	Less than 5%	9
		Greater than 5%	7	Greater than 5%	45

These groups are the same as are referred to on page 8 and it will be seen that those samples running above 7·5 per cent reducing sugars in group 3 are all samples with abnormally high solids.

6. LICORICE, GLYCERIN, AROMATICS.

These substances are used to disguise the bitter taste of the cascara. No quantitative work was done except in the case of glycerin. The exact determination of glycerin in such admixture presents considerable difficulty. An approximation was arrived at by the method of boiling off in steam; 10 cc. of the aromatic extract was slowly heated to 160° C., and by the addition of small quantities of water from time to time the glycerin was boiled off. The glycerin was estimated to be the difference between the solids remaining at this temperature and those remaining after one drying at 110° C.

A certain increase in weight occurs due to the slow oxidation at this temperature. It is also very likely that some glycerin becomes non-volatile during the process. The sum-total of these errors, however, as determined through such suitable blanks as could be devised, is not great enough to destroy the usefulness of the method. The chief error arises from oxidation of the solids during the process. This may amount to a 2 per cent increase W/V of the total solids present, after eight hours at 160° C. A mixture of pure glycerin and a genuine cascara showed that practically all the glycerin could be driven off in this way.

It may be calculated that there should be about 25 per cent glycerin present W/V in a U.S.P. aromatic extract. Out of seventeen samples, examined twelve of which belonged to group 2, eight were found to be below 25 per cent.

No attempt was made to identify any of the aromatic substances used. They are present in very small quantities and are quite harmless.

7. ASH.

The value of an ash determination becomes evident from a consideration of its variation. If some attempt has been made to debitter the extract by application of lime, soda, ammonium salts, or magnesia, it is possible, that through contamination or solution these may greatly increase the ash in amount. Such was found to be the case. The colour of the ash, when heated strongly in a muffle is also a good indication of the nature of the sample. The ash from an aromatic extract containing glycerin and licorice will be greyish white. The ash from samples containing excess of lime salts will be pure white. The ash of genuine samples will be some shade of green depending on the amount of manganite salts present. This manganese comes from the bark and is sufficiently soluble in the water extract to be found in this way in the ash. The calcium in the ash is not a constituent which might come from percolation of the bark and the solution of calcium salts. These salts are not removed to any extent by boiling the bark in water, and are evidently present in the bark as oxalate and carbonate. A table of the ash values follows. It will be seen that in classes 1 and 2, which are aromatic and nondescript samples, the range is very wide. In group 3, however, where the liquid and fluid extracts are tabulated, the range is seen to be within more reasonable limits.

The ash varies as the solids extracted. For a sample extracted by B.P. method giving 21 per cent solids the ash was 0·96 per cent, and for sample extracted by U.S.P. method giving 30 per cent solids the ash was 1·08 per cent. In both cases the ash was a beautiful green colour.

Tables dealing with the ash of seventy-seven samples:—

TABLE 6.

Group 1.		Group 2.		Group 3.	
1 to 1·5%	1	Below 1%	1	0·0 to 0·5%	1
1·5 " 2·0	1	1 to 1·5	0	0·5 " 1·0	33
2·0 " 2·5	1	1·5 " 2·0	1	1·0 " 1·5	18
2·5 " 3·5	9	2· " 2·5	2	1·5 " 2·0	5
3·5 " 4·0	4	2·5 " 3·0	0	2·0 " 2 5	1
4·0 " 5·0	0	3· " 3·5	1	3·0 " 4·0	1
5·0 " 5·5	1	3·5 " 4·0	4		
		4·0 " 4·5	1		
Total	8	Total	10	Total	59

It would seem from our experience that a range of from 0·7 to 1·1 per cent for the ash of genuine liquid extracts of cascara would not be unjust. Any extracts either above or below these limits were found to be abnormal in some respect.

8. MANGANESE NUMBER.

An attempt is here made to take advantage of the fact that the bark of *Rhamnus purshiana* contains a relatively large quantity of manganese which is soluble by the method of percolation. As stated above, the manganese gives a green colour to the ash. The general usefulness of this determination depends on the fact that the manganese content of this bark is greatly in excess of that of any other laxative drug, except *Rhamnus frangula*. This drug is one that is imported and its cost is such that it is not likely to become an adulterant of *Rhamnus purshiana*. In the majority of liquid extracts, then, where cascara is the only drug extractive present a determination of the manganese content of the ash becomes a semi-quantitative measure of the actual amount of cascara extractive present. Before trusting to such data it is necessary to show that the manganese content of cascara is fairly uniform or at least define its limits. To this end various samples of this bark were obtained and in particular guaranteed samples were kindly supplied by Parke Davis & Company. The percentage of manganese in the bark depends on its thickness. In general the inside shows a much higher content than the outside and the thinner bark shows a higher percentage than the thicker. From an examination of selected bark it was determined that on an air-dry basis the lower limit for thick bark is around 0·0093 per cent Mn. and the upper limit 0·015 p.c. Mn. No doubt selected bark might run below and above these limits. For the purpose of this work where the manganese is used as a standard the lower limit is the more important, and it is safe to say that the most or greater part of the bark coming on the market easily reaches this standard. For our purposes it was necessary to show that the methods of percolation extracted this manganese in a uniform manner. It was found that for a definite method of percolation, the manganese was extracted in proportion to its total amount in the bark. Thus it was found that a bark whose original manganese content was 0·099 per cent gave in its extract 0·0023 p.c. Mn. when the B.P. method of percolation was used. This same bark when extracted by the U.S.P. method gave as previously stated 30 per cent solids and 0·0028 p.c. Mn. The manganese is extracted proportionally to the solids and about one-quarter of the total manganese is available in the extract from cascara bark. These are lower limits as more than these amounts were found in many samples. These may be taken as the minimum amounts that should be present provided genuine

cascara bark has been used and no dilution of the extract has taken place. For a liquid extract one cc. is the equivalent of one gram of the bark. Thus, providing the method of extraction is known, the percentage of manganese W/V of the extract is in direct proportion to the percentage extracted. Since the percentage extracted is uniform for a given method, this number should be a direct measure of the bark equivalent of the extract. Thus we have developed what may be defined as a MANGANESE NUMBER. This is the per cent W/V of manganese × 100,000. It is necessary for us to place our lower limit at 0·0023 per cent, as all official methods may not give the same result if the detail varies. The amount of manganese extracted from cascara bark should be approximately proportional to the solids extracted. That is the per cent of manganese in the total solids of a genuine extract should be approximately constant, provided the method of extraction is uniform. Considering all our results where extraction may not have been uniform, this number ranges from 0·01 to 0·025 for samples deemed genuine. If this number falls below this, it is evident that the solids of this extract are not all cascara solids. This test is of value in distinguishing extracts of *Rhamnus californica* and *Rhamnus purshiana*. Only one sample of *Rhamnus californica* was available. This was mature bark of the same order of thickness as the cascara giving us our lower limits. Its total manganese content was 0·0027 per cent. This gives a correspondingly low extractive of 0·0008 per cent. It is thus apparent that an extract from this bark would have a much lower manganese number than an extract from *Rhamnus purshiana*. Whether or not some of the extracts examined which show low manganese numbers have been prepared from this bark is a matter of inference. Examination of *Rhamnus frangula* proved that the bark contained on the average about three times as much manganese as *Rhamnus purshiana* and extracted about four times as much by the same procedure. For mature bark 0·0248 per cent Mn. was found present. For one sample of thinner bark 0·0626 per cent Mn. was determined. This in itself is quite remarkable as it is by far the highest per cent of manganese so far determined in any organic substances of this nature from data available. All these calculations are made on air-dry samples whose moisture content ran from 7 to 7·5 per cent.

Before coming to the application of this determination, and its value in a study of aromatic extracts, it is necessary to discuss the manganese content of licorice root, and the more common laxative drugs such as senna, rhubarb, aloes and wahoo bark. Work was done on these similar to that above. The total manganese content of senna leaves was 0·0040 per cent, rhubarb 0·0034 per cent, licorice root 0·0025 per cent, wahoo bark 0·0020 per cent, and barbadoes aloes 0·0006 per cent. The licorice and the senna are the only two that will be mentioned. Licorice occurs in nearly all aromatic preparations and senna is often sold in admixture with cascara. Water extracts of these showed very small amounts of manganese to be extracted. It is thus seen that when these drugs displace cascara the manganese content will be very much lowered. On the other hand if they are present in addition to the cascara extract the total manganese content would only be slightly raised by their presence and the percentage of total manganese based on total solids would be much below that of a genuine extract. Thus even while considering aromatic extracts it is safe to say that their manganese content varies directly with their cascara content.

It was found best to work on 10cc. of the extract, or on 10 grammes of the bark. The ammonium persulphate method with silver salt as catalyser was used. The sample was completely ashed and taken up directly with about 15cc. of concentrated sulphuric acid in platinum. This was heated till the acid fumed freely. This was then washed either into a beaker or a volumetric flask.

If the ashing has not been complete this solution may be filtered on dilution and again ashed. For small amounts up to 0·004 per cent manganese good work may be accomplished by using a volumetric flask of 100cc. capacity. The colour obtained on this dilution may be compared with that of standard permanganate solution made up

as nearly as possible like the solution to be tested with special regard for duplicate acid concentrations. For percentages higher than this, and using a 10 gramme sample the colour will be so deep that a larger volume of solution must be used. Unless the solution is sufficiently dilute a hydrated form of manganese will precipitate out. For a 10 gramme sample running 0·02 per cent manganese a dilution of at least 400cc. is necessary in order to avoid the formation of the hydrated form on the addition of the ammonium persulphate. One cc. of silver nitrate solution made from 5 grammes of this salt per 100cc. was added as a catalyser. The solution was then warmed to about 80° C., and a gramme of ammonium persulphate was added. The solution was then allowed to stand on a steam bath. The colour did not always come at the same rate but it was certainly complete at the end of one hour. It was then cooled and titrated with standard sodium arsenite solution or if sample contained low percentages of manganese it was compared colorometrically. We were able to check results working both ways or either way.

A table follows in which the manganese numbers are given as defined above. Seventy-six samples were tested in this manner.

TABLE 7.

Group 1.		Group 2.		Group 3.	
Range of Manganese.	Samples.	Range of Manganese.	Samples.	Range of Manganese.	Samples.
0 to 50	3	0 to 50	5	0 to 100	0
50 " 100	1	50 " 100	1	100 " 150	6
100 " 150	1	100 " 150	0	150 " 200	5
150 " 200	2	150 " 200	3	200 " 250	7
200 " 400	0	200 " 250	2	250 " 300	10
400 " 450	1	250 " 400	0	300 " 350	6
		400 " 450	1	350 " 400	3
		450 " 600	2	400 " 500	13
		600 " 700	1	500 " 600	1
				600 " 700	1
	Total 8		Total 15		Total 53

From this it will be seen that a large number of aromatic extracts and trade preparations are exceedingly low in cascara extract. It may be doubted if some of them contain even more than a trace. The fluid extracts appear at their true advantage under this test. It is to be noted that an aromatic extract properly prepared does reveal its cascara content by this test. The higher numbers in groups one and two show this.

9. COLOUR REACTIONS AND TESTS.

The Bornträger reaction is most general for emodin-bearing drugs. If the aqueous extract is acidulated and extracted with benzol and the extract washed with water a red colouration will appear in the aqueous layer when this is made alkaline. This test holds good in the presence of emodin or other anthraquinone compounds. Cascara will respond to the test in greater dilution than any of the other drugs that come in this class. Senna fails to always respond to this test in a satisfactory manner and no conclusive evidence of its presence is to be gained in this way. Its presence, however, does not destroy the test when the slightest trace of cascara is present. Phenolphthalein of course will mask these tests. It may be removed by the method of Warren Amer. J. Pharm. 86, 1914, p. 444. This procedure could not be applied

to so many samples where its presence was not even suspected. There is a difference in the colour given by cascara alone, and phenolphthalein alone, that may be distinguished. The cascara is a deeper red and is more the colour of methyl orange. Even in admixture there is a difference in the colour which is quite distinct from that given by either of the substances alone. Moreover the phenolphtalein colour fades when the solution is made strongly alkaline and allowed to stand. In this way all samples were tested and compared with standards and in no case was any evidence of the presence of phenolphthalein observed. It was found impossible to detect other emodin-bearing drugs in the presence of such large quantities of cascara. All colour reactions where alkaline salts are used as a basis and where the formation of rings of different shades is depended upon were found untrustworthy. In every case the cascara masked such faint differences as are to be noted when comparing genuine individual extracts. A pure extract of rhubarb will give on ether extraction a blue colouration when brought in contact with solution of ferrous sulphate. When one tries to follow this reaction in the presence of 50 per cent cascara extract the difficulty is greatly increased because although cascara does not give the same shade of blue it does give a colouration which may be sufficiently dense to make the detection of rhubarb almost impossible. It is thus quite evident that small percentages of emodin-bearing drugs are much more likely to be missed than they are to be positively identified when present in small and unknown admixture with cascara. Hubbard reviews (Jour. Ind. and Eng. Chem., 1917, p. 518) the generally known colour reactions for these drugs. He concludes that senna is the most difficult to detect. In the presence of ammonium thiocyanate the ether extract of senna is said to give a yellow to brownish colour, also with ammonium molybdate. We were unable to obtain these colourations and in each case observed no colour change. A good method for the detection of senna would be of great assistance in the examination of cascara mixtures as this drug is the one most likely to be found in admixture in many trade preparations of cascara. The absolute detection of aloes has been probably better worked out than any of the others. Mossler, Pharm. Post. 46, 1917, p. 313, claims the ability to detect 0·2 g. of aloes in 5 grammes of rhubarb or cascara. The fluorescence test for aloes in the presence of cascara, using borax solution with the ether extract, is certainly not delicate enough to be of much value when the cascara is in any great excess. In general it may be said, that the extracts of these drugs give a red colouration in solutions where the hydroxyl ion is present in excess. In the Bornträger reaction ammonia is used directly. Borax solution amounts to practically the same thing since it gives an alkaline solution through hydrolysis. Chlorinated lime is in the same class. Any alkaline salt will give the same red colouration that is obtained by ammonia in the Bornträger reaction and neutral or acid salts will not give it. Shades or differences in colouration may be due to the presence of various cations in such a variety of salts. The depth of colour produced by equivalent amounts of cascara, aloes, rhubarb and senna, ranges from strong to weak in the order named above.

The Borntrager reaction was carried out on seventy-six samples. In one case the emodin reaction was distinctly negative. In fourteen samples the reaction was very faint. This shows the presence of only traces of cascara at best. All these fifteen samples come in groups 1 and 2.

Although adulteration of these extracts by other drugs was not particularly suspected, tests were attempted on a number of samples for the presence of aloes and rhubarb by means of the borax test and ferrous sulphate. In no case were these tests deemed to be positive although they cannot be taken as absolutely conclusive. Some samples were declared to contain senna. We were unable to positively identify the presence of this drug.

It must be stated once again here that we have not tried to classify these samples in this part of our report strictly according to the way they were sold to our inspectors.

The general public cannot be expected to appreciate the difference between aromatic and fluid extracts of cascara. Although the simple name Cascara Sagrada refers strictly speaking to a bark and not to any particular extract, yet a large number of extracts were sold simply as "Cascara Sagrada." This implies nothing on their part as to the nature of their composition. This may in one sense be considered a case of misbranding. It really is the outcome of the public's attempt to prescribe for itself in semi-intelligent terms. As a rule the manufacturer has taken advantage of the possibilities in the manufacture of aromatic extracts. Licorice and glycerin are found to have unduly displaced the cascara extract that should be present in these samples. These extracts are also unofficial in that they do not contain the required alcohol content.

The liquid and fluid extracts are much nearer official standards, and their intrinsic value as laxatives is, on the average, much greater.

L. E. WESTMAN,
R. M. ROWAT,
Public Analysts.

BULLETIN No. 387—BEANS.

OTTAWA, December 11, 1917.

SIR,—I have the honour to present you with a report upon 318 samples of Beans, as found upon the Canadian retail market in August, September and October of this year.

Beans constitute a highly nutritious food for man, as well as for domestic animals. Konig (Zusammensetzung, etc. Vierte Auaflge, Band 1, S. 1484) quotes the following percentage value:—

		Water.	Protein.	Fat.	Carbohydrates.		Ash.
					Starch.	Fibre.	
1	Phaseolus vulgaris	18.20	18.44	0.78	45.32	4.29	3.29
2	" lunatus	10.31	19.56	2.48	46.46	4.93	4.07
3	Soya beans (mean)	14.38	35.43	18.20	15.00	6.48	3.98

It will be noted that the proteid matter of the bean is very high, and this is particularly true of the Soya (Soja) bean, which is also specially rich in fat.

The experiments of Thomas (Lusk, Fundamental Basis of Nutrition, p. 20) show that the protein of beans has a higher nutritive value than that of bread, and nearly twice as high a value as that of Indian Corn.

Using the prices which obtained in New York, in January, 1913, it was found that each 1,000 calories of energy furnished by dried beans, cost 4 cents, as against wheat flour, 2½ cents; wheat bread, 5⅓ cents; milk, 10 cents; mutton, 16¼ cents; sirloin beef, 24 cents.

The bean is readily grown in most parts of the world. In tropical climes it develops a glucoside (Phaseolunatin) which yields hydrocyanic (prussic) acid on

hydrolysis, the amount of this acid frequently reaching dangerous quantities, especially in beans grown in Java and Burma. Java beans, coming into France by way of Algeria, caused fatal illness; and in consequence of this a decree was issued in 1912 forbidding the importation of Java beans, and also of other beans found to yield more than 20 parts per 100,000 of prussic acid (equivalent to approximately 20 milligrammes in 3 ounces). The maximum dose permitted by the British Pharmacopoeia for prussic acid is 6 milligrammes; and it will be seen that three ounces of beans (not more than a hungry man might eat at one meal) containing as much as 20 milligrammes would certainly be fatal, unless the poison were got rid of before serving the food.

Fortunately, the nature of ripe beans is such that they cannot be prepared for the table without more or less prolonged soaking, followed by boiling. The prussic acid, being volatile, is thus got rid of in the steam, and residual amounts are usually so small as to be harmless. Nevertheless, cases have come to my notice to prove that serious illness may occasionally result from the use of these beans, although no fatalities are on record in Canada.

Numerous and large consignments of East India Beans have recently come to Canada; and this is particularly the case since the United States has forbidden the entrance of these beans found to contain "appreciable amounts of prussic acid" (Service and Regulatory Announcements, No. 219—published July, 1917).

Up to the present time we have the following record of importations of beans, since June of this year:—

	Via	Port of	
Vancouver (46 described as Soya Beans)	446	Hamilton	2
Victoria	8	St. John, N.B	4
Winnipeg	3	Sudbury	1
Saskatoon	2	Montreal	18
Ottawa	3	Port Arthur	2
Halifax	9	North Bay	1
Belleville	1	Calgary	1
Quebec	4	London	2
Moose Jaw	1		
Toronto	24	Total Importations	532

The above list includes beans of many different varieties. All have been examined as to their prussic acid content and the following synopticizes the result.

Containing no prussic acid	280	samples
" from traces to 10 parts per 100,000	49	"
" " 10 to 15 parts per 100,000	121	"
" " 15 to 20 " "	63	"
" more than 20 " "	19	"
Total	532	

Pending investigation as to the character of the importations into Canada, I advised this Department to adopt the limit set by the French Decree of 1912, and to forbid delivery of any beans found to yield more than 20 parts of prussic acid per 100,000. This recommendation has been acted upon, and as above stated, no fatalities have been reported from the use of these beans.

Several cases of more or less serious illness have however come to the notice of the Department; and it has become a matter of grave importance to decide whether or not the above limit is sufficiently conservative.

Investigation proves that proper soaking and subsequent boiling of the beans, rejecting in the first place the water in which these were originally soaked, is sufficient to render the beans safe as food. Any failure to observe the precautions named, may result in more or less dangerous consequences. It is during the soaking process that the poison is developed, and sufficient time must be allowed for this operation. It is best to let the soaking proceed overnight. By pouring off this water, most of th prussic acid is got rid of, and the subsequent boiling with frsh water makes the

beans quite safe in use, when the total content in prussic acid does not exceed 20 parts per 100,000.

Cases of illness, so far as these have been fully investigated, appear to show that the beans have not been prepared for the table as above described; and in consequence the poison has not been boiled off. Whether due to ignorance or carlessness, the danger is sufficiently real and acute; and it is open to question whether we are justified, even in the present food stringency, in taking such risk as is involved in permitting beans, carrying 20 parts prussic acid per 100,000, to be distributed. As already stated, this limit has been accepted by France since 1912; and I have not heard of any fatalities attending the use of beans, in that country, since the date named. I understand however, that a much lower limit of tolerance is fixed by the United States, and this probably accounts for the very large shipments of these beans to Canada in recent months.

The special object had in view in the collection now reported, was to discover to what extent beans containing prussic acid were distributed in Canada, and the results may be summarized as follows:

Samples yielding	no	prussic acid	173
"	"	less than 10 parts	61
"	"	10 to 15 parts	40
"	"	15 to 20 parts	39
"	"	above 20 parts	5
		Total	318

As already stated, this Department has refused admittance, at all Canadian ports, to beans yielding more than 20 parts prussic acid per 100,000 parts, since June last. It may be that the 5 samples found upon our retail markets, and showing more than 20 parts per 100,000 represent importations delivered before June 1917.

The distribution of these cyanogenetic beans is apparent from the following table of localities in which collections was made:

Inspectoral District	Total samples	Free from prussic acid	Containing prussic acid
Nova Scotia	15	14	1
New Brunswick	15	14	1
Quebec (city)	35	29	6
" (province)	27	21	6
Three Rivers	10	7	3
Eastern Townships	5	5	0
Montreal	15	13	2
Valleyfield	15	14	1
Ottawa	14	3	11
Kingston	13	11	2
Toronto	15	6	9
Hamilton	14	7	7
Windsor	10	7	3
North Ontario	13	7	6
Manitoba	15	0	15
Saskatchewan S	15	0	15
Saskatchewan N	13	0	13
Alberta	15	0	15
Rocky Mountains	14	12	2
Vancouver	15	2	13
Victoria	15	1	14
Total	318	173	145

It is apparent from this statement that these beans are mainly entered at the West seaboard of Canada, and are finding their way eastward; already practically monopolizing the market as far east as Manitoba.

It is very important, from another point of view than that of safety in use, that these eastern beans should be sold under a name which clearly distinguishes between them and beans which are the product of a temperate climate. Their nature is such that when planted in our climate, they do not mature; and it would be quite possible for a farmer to lose the whole season's crop, if, by mistake, he sowed Oriental instead of native beans. I find that the great majority of sales made to our inspectors are simply described as "beans"; 17 sales of these beans were made as "white beans" and 3 as "navy beans". In a few cases only were they sold as "Burma" or "Rangoon" beans; though more frequently as "Japanese" beans. They are not actually the product of Japan, but are usually shipped by way of that country.

It may be necessary to insist upon all beans being offered under a name that shall inform the purchaser regarding the nature of the article; or at least to require that Oriental beans shall not be sold except under a name that shall make it impossible for the purchaser to mistake them for the native variety.

BULLETIN No. 388—REGISTERED FEEDING STUFFS.

OTTAWA, December 17, 1917.

SIR,—I beg to hand you a report dealing with 146 samples purchased as Registered Feeds, by our inspectors, in June, July, and August of this year. Our last report upon this class of Feeds was made in November, 1914, and is published as Bulletin No. 296 of this series.

There appears to be much misunderstanding as regards so called Registered Feeds; and I am of opinion that this misunderstanding is without excuse. The Commercial Feeding Stuffs Act of 1909 makes it quite clear that all Feeds must be sold under a specific registration number, and accompanied by a guarantee of nutritive values, except the following:—

1. Hay and straw;
2. Roots;
3. Unground whole grain, of one kind or in admixture;
4. Meal, the product of grinding the entire grain of one or more kinds.
5. Wet brewers' grain.
6. Bran.
7. Shorts (Middlings).
8. Chop Feed.

This last class is practically identical in character with number 4, except that the grains are merely broken, and not ground to the fineness of meal. The last three classes are defined in detail by Order in Council of May 1, 1911 (published as G. 698) as below:—

"Under the authority of an Order of His Excellency in Council, bearing date the first day of May instant, paragraphs 13, 14 and 15 of the Order in Council of the 29th October, 1910, establishing standards of quality for grain products, have been cancelled and the following substituted in lieu thereof:—

"13. *Bran* is a product of the mililng of wheat or other grain and contains not less than fourten (14) per cent of proteids, not less than three (3) per cent of fat, not

more than ten (10) per cent of crude fibre and must b free from vital seeds of any of the noxious weeds defined by the Governor in Council under 'The Seed Control Act.'

"14. *Shorts or Middings* is the coarser material sifted out from the products of second treatment of the grain by crushing the coarsely ground material that is sifted out from the bran after the first grinding; and contains not less than fifteen (15) per cent of proteids, not less than four (4) per cent of fat, not more than eight (8) per cent of crude fibre and must be free from vital seeds of any of the noxious weeds defined by the Governor in Council under ' The Seed Control Act.'

" 15. *Chop Feed* is whole grain of one or more kinds more or less finely ground, and contains not less than ten (10) per cent of proteids not less than two (2) per cent of fat, not more than ten (10) per cent of crude fibre and must be free from vital seeds of any of the noxious weeds defined by the Governor in Council under 'The Seed Control Act.' "

These amended standards will come into force on the seventh day of June proximo."

Under these regulations it must be quite apparent that, whilst the accidental occurrence of a few weed seeds or other extraneous matters into Bran, Shorts or Chop may not be held to constitute adulteration, so long as the nutrient value of the article is maintained, the purposeful addition of screenings to any of these classes so changes the nature of the Feed that it no longer meets the conditions of definitions.

The only legal way of marketing such a Feed is to register it as a mixture, and to sell it under the conditions of section 5 of the Act.

This is also true of an article which is usually sold as Feed flour (see Bulletin No. 350). Although usually offered as Shorts or Middlings, this material is not such in any proper sense, and should be sold as a registered Feed.

Owing to mistakes on the part of our inspectors, 25 samples of Cattle Medicines are included in this collection. These have not been analyzed but are held over for work and report when this class of articles is taken up. The results of this inspection may be summarized as follows:—

Samples purchased mistakenly	25
Samples which meet legal requirements	53
Samples which nearly meet legal requirements, or possess guaranteed value by compensation	14
Samples sold without registration numbers	25
Samples below legal requirements	20
Samples sold as legal Bran, Shorts &c	9
Total	146

Fourteen samples, which are very slightly below legal requirements, or which contain proteins in such excess above guaranteed value as to fully compensate for deficiency in fat, or vice versa, may perhaps be recommended to be passed, without penalty. In strict legal interpretation, these samples are adulterated under the Act; but the purchaser sustains no loss by this fact.

Twenty-five other samples are sold without attached registration numbers and are therefore illegal These are .subject to penalty under Section 15 of the Act. I have reason to believe that, in several instances, the fault is not due to the manufacturer, who registers his product according to law, but to the retail vendor, who offers the article for sale without furnishing the purchaser with information as he is required by law to do. Section 7 of the Act is as follows:

" The registration number must be affixed by the manufacturer or agent in a plain and legible manner to every package of commercial feeding stuff sold or offered for sale, and shall constitute an identification of the brand. In addition to the registration number, there must be legibly printed, on every package of feeding stuff

sold, the statement set out in schedule A to this Act. This condition shall be held to be fulfilled if a printed tag bearing the registration number and the statement required is securely attached to the package."

I have learned that in some cases it is usual for the manufacturers to furnish necessary tags, leaving to the retailer the responsibility of affixing these tags to packages sold. Whether or not the manufacturer guards himself from penalty by such procedure would have to be decided by the courts. This Department must hold the immediate vendor responsible since he alone is in a position to know the facts.

Twenty samples fail to meet guaranteed values; and of course such samples are adulterated under the Act.

BULLETIN No. 390—FLAVOURING SYRUPS, Etc.

OTTAWA, December 19, 1917.

SIR,—I would respectfully call your attention to the fact that, during recent years, this department has frequently been asked to look into the matter of fruit syrups and kindred preparations as supplied to the trade for use in soda fountain beverages. We have been prevented from taking up the subject earlier by press of other work; but in June of this year I caused a collection of 141 samples to be made in the cities and principal towns of Canada, and these have been carefully worked over, with results as inclosed. The investigation was placed in charge of Mr. Geo. H. Brother of this staff, and his report is herewith submitted.

An Order in Council of February, 1911 (published as Circular G. 947) defines fresh fruit juices and sweet fruit juices; but only in very general terms, and without special regard to the employment of these articles for soda fountain use. The beverages offered at these fountains are not usually claimed to be fruit juices, but are essentially ærated water (soda water) flavoured with a fruit juice, which may be actually such, or may be a synthetic preparation imitating the fruit which gives its name to the drink. In the latter case, the satisfactory character of the preparation, so far as flavour is concerned, will depend upon the skill of the manufacturer; and provided that the ingredients are harmless, and that the article is properly described as an imitation, and not as a true fruit juice, there is no ground for complaint. The employment of preservatives and dyes, under the conditions of G. 1111 and G. 1167 is permitted.

These soda fountain syrups are now so largely used that it is desirable to define them more closely than at present is the case under G. 947; and it was mainly with a view to obtaining information regarding them that the work herein reported was undertaken.

Three of the samples, sold as orange flavouring syrups, contain no sugar; and are not syrups, two being concentrated fruit juices, preserved with salicyclic acid

and formaldehyde, and one a synthetic preparation. The remainder are true syrups (containing sugar) and the results of their examination are summarized as follows:—

Name.	Total samples.	Source of Flavour.			Dyes.			Preservatives.				
		Natural.	Synthetic.	Doubtful.	None.	Certified.	Uncertified.	None.	Ben. acid.	Sal. acid.	Formal-dehyde.	Alcohol.
(1) Strawberry	27	23	2	2	9	12	6	8	14	2	2	1
(2) Pineapple	22	21	1	0	21	1	1	10	7	2	2	1
Cherry	21	20	0	1	2	13	6	7	6	7	1	0
Lemon	18	7	8	3	4	10	4	12	1	4	1	0
Orange	15	6	6	3	3	2	10	5	3	5	2	0
Raspberry	11	7	0	4	1	9	1	3	6	1	1	0
Vanilla	7	6	1	0	7	0	0	5	0	1	1	0
Chocolate	6	6	0	0	6	0	0	6	0	0	0	0
Peach	3	3	0	0	3	0	0	0	2	0	1	0
Coffee	1	1	0	0	1	0	0	1	0	0	0	0
Ginger,	1	1	0	0	1	0	0	0	0	1	0	0
Sarsaparilla	1	0	1	0	1	0	0	1	0	0	0	0
Rose	1	0	0	1	0	0	1	0	0	0	1	0
Fig	1	1	0	0	1	0	0	0	1	0	0	0
(3) Claret	1	0	0	1	0	0	1	0	0	1	0	0
Grape	1	0	1	0	0	0	1	0	1	0	0	0
(4) Rainbow	1	1	0	0	0	1	0	0	1	0	0	0
Apricot	1	1	0	0	1	0	0	0	1	0	0	0
Banana	2	0	2	0	1	1	0	0	2	0	0	0
	141	104	22	15	62	49	31	58	47	22	12	2

(1) Alcohol 19·18 p c. volume.
(2) " 35·51 "
(3) Contains no alcohol.
(4) Mixture cherries and pineapple.

The information furnished herewith will assist your Advisory Board in defining soda fountain syrups:

December 14, 1917.

Dr. A. McGill,
Chief Analyst.

Dear Sir,—I beg leave to submit the following report on the examination of 141 samples of fruit juices or syrups for soda fountains as used throughout the Dominion.

There is no specific definition for this class of products given in the Adulteration Act, though in G. 947 (February 11, 1911), are the following:—

1. *Fresh Fruit Juices.*—1. "Fresh fruit juices are the clean, unfermented liquid products obtained by the first pressing of fresh, ripe fruit, and correspond in name to the fruits from which they are obtained, and contain not more than two (2) per cent of alcohol by volume."

4. *Sweet Fruit Juices, Sweetened Fruit Juices, Fruit Syrups.*—1. "Sweet fruit juices, sweetened fruit juices, fruit syrups, are the products obtained by adding sugar (sucrose) to fresh fruit juices, and correspond in name to the fruits from which they are derived."

It is worthy of note that in neither of the above definitions is there any mention of synthetic fruit syrups, i.e., syrups made from synthetically prepared esters and acids imitating those found in the natural fruit, nor of the addition of preservatives and artificial colouring matter.

Since, as I have stated above, there are no specific standards set for fruit syrups intended for fountain use, it is important that deviations from the existing standards be examined to determine whether or not they should be classed as adulterations. Of course syrups containing substances harmful to health will not be considered under this head: there is absolutely no doubt or question as to their adulteration, on other grounds than that they are a menace to the health of the public.

Synthetic Fruit Syrups.—The use of synthetic, or manufactured preparations for flavouring purposes, such as methyl salicylate for oil of wintergreen, vanillin or coumarin for vanilla extract, ethyl butyrate for pineapple, etc., is quite common. They are cheaper and easier to prepare than the natural extracts, hence bring the manufacturer larger profits if they can be sold at approximately the same price charged for extracts. These preparations are inferior to the natural extracts, since the latter owe their delicate flavour to resins and traces of other esters besides the principal one; the former are practically nothing but an alcoholic solution of the principal ester. The result is that, while the preparation may be stronger (in the sense that less is required to produce the flavour), the natural extract is the more pleasing to the taste. To protect the public and yet permit the sale of synthetic preparations, an Order in Council (G. 1276, April 7, 1917) requires the synthetic preparations to be labeled "Imitation" or "Artificial" in letters as large as the rest of the label.

The problem of protection is somewhat different in the present case, since the public purchases fountain flavours only in mixtures. It is, of course, possible and desirable that manufacturers of syrups be required to conform to a regulation similar to that cited above, but this would protect the vendors only. In order to protect the general public, I would recommend a requirement that fountain drinks or preparations flavoured with synthetic flavours be sold over the counter as "mock" strawberry, "mock" pineapple, etc., as the case may be, and that they be so listed or described on the printed menus.

Preservatives.—There is no strong objection to the use of the permitted preservatives (G. 1111, April 15, 1914) in this class of fruit syrups. The syrup is so diluted when sold to the consumer that none of the listed preservatives would be harmful, even though present in somewhat larger quantities than permitted. It is true there remains the question as to whether any other preservative than the sugar is necessary. Barnard (Chem. Abst. 3 (1909), 2475), claims that fruits preserved in 10 pounds sucrose per gallon of water keep at least seven days, exposed to room temperature during the day and placed in a refrigerator at night; if preserved in 14 pounds sucrose, a syrup results "sufficiently heavy for all practical purposes" which keeps under any ordinary conditions. As no work along these lines has been done in this laboratory up to the present time, we are unable to comment on Barnard's work. As stated above, however, there is no reason why permitted preservatives in reasonable amounts should not be used, provided they are declared by the manufacturer on the label.

Artificial Colouring.—Freshly prepared fruit syrups are beautifully coloured, due to the natural pigments present in the fruit. Exposure to light causes most of these colours to fade, often to a very unpleasing shade. The fruit itself is not affected, but its appearance renders it unattractive. This would unjustly and seriously affect the business of the dispenser, were it not possible to reproduce nature's colours by the addition of small amounts of harmless dyes. The Department has, therefore, certified in G. 1167, January 18, 1915, seven aniline dyes for use in colouring of foods, as follows: Amaranth 107, Ponceau 3R 56, Erythrosin 517, Orange 1-85, Napthol Yellow S4, Light Green SF Yellowish, 435, Indigo Carmine 692, and in G.

1278, April 21, 1917, Tartrazine 94. The numbers refer to the classification by Schultz and Julius, as edited by Arthur G. Green.

Among these eight certified colours are found the three primary colours (red, blue and yellow) as well as the complementaries, orange and green. They are sufficient, therefore, to satisfy every demand, since combining two or more of them practically any colour or shade may be produced. The United States have eight certified colours: Amaranth 107, Ponceau 3R 56, Orange 1-85, Tartrazine 94, and Indigo Carmine 692. Erythrosin 517, Napthol Yellows 4, Light Green S. F. Yellowish 435, The National Aniline and Chemical Company, Inc., of New York, has combined these so as to produce fifteen shades and colours besides the original certified eight, which they sell under such trade names as "Strawberry Red," "Deep Chocolate," "Yellow Colour, Egg Shade," etc. They have kindly furnished us with samples of all their certified colours for food products and confectionery. Investigation of these samples has demonstrated the fact that manufacturers of fruit syrups have here every colour and shade of the natural fruit, so have no excuse for the use of any but certified colours. As will be shown later, the majority of samples of fruit syrups examined were found coloured with certified dyes, a fact much to the credit of the manufacturers as this is the first examination of this class of fruit syrups, as well as the first investigation of dyes used to colour food products in this laboratory.

The method used for the detection and identification of the dye is outlined in the Journal of the Association of Official Agricultural Chemists (J.A.O.A.C, 2, 161). A piece of white woollen yarn is boiled for about fifteen minutes in the solution to be tested, to which a few drops of hydrochloric acid have been added. It is then removed, washed well with water and dried. If an aniline dye is present in the solution, the wool will be fast dyed. When dry it is cut into four pieces, which are treated with concentrated hydrochloric and sulphuric acids, and dilute solutions of sodium and ammonium hydroxides. The colour reactions are noted and by means of a table of these reactions the dye is identified. This identification can be regarded as only approximate, as the method is rather crude, some of the reactions as given in the table being questionable. For example Amaranth 107, according to the table, gives reactions which we could not duplicate with samples of the pure dye. To show these discrepancies, we will copy the reactions as given in the table and under them give those we obtained with two separate samples of the pure dye:—

——	Hydrochloric.	Sulphuric.	Sod. Hydrox.	Ammonia.
Given.....	Slightly darker.	Violet to brownish.	Dull brownish.	Little change.
Found.....	Deep red.	Violet.	Red.	Red.

There is no doubt about the violet colour with sulphuric acid, as the table would lead one to believe; not only did the two samples of pure Amaranth 107 give a very decided violet colour but also five red compound colour (strawberry red, etc.) showing Amaranth to be the base dye used in their construction.

Several syrups contained dyes we were unable to identify; these we classed as "artificial" dyes and considered them uncertified. The subject of dyes and their identification is being further investigated and we hope soon to get out our own table of colour reactions and a more rigorous method than that described above. We are much indebted to Mr. W. H. Watkins, chief chemist of the Buffalo factory of the National Aniline and Chemical Company, Inc., for assistance on this subject.

In order to facilitate comparison, tables have been prepared in which the data on all samples of the same flavour is listed. This also permits more extended remarks and criticism than would be possible were the data given in one large table.

STRAWBERRY (27 SAMPLES.)

Sample No.	Analyzed at.	Dye.	Preservative.		Sucrose p. c.	Analyst's Description.
			Substance.	p. c.		
76602	Halifax	Amaranth 107	None			Genuine syrup.
76605	"	Ponceau 3R 56	"			Doubtful syrup.
78045	"	None	"			Genuine syrup.
78046	"	"	"			Genuine fruit.
71216	"	Amaranth 107	"			Genuine syrup.
65261	Ottawa	None	Benzoic acid	0·0619	36·27	Genuine fruit.
65264	"	"	"	0·1135	7·02	Genuine fruit.
65269	"	Amaranth 107	"	0·2167	26·05	Genuine syrup.
72591	"	None	None		29·44	Genuine syrup.
77515	"	Artificial	Alcohol	19·18	2·56	Synthetic syrup.
77534	"	Ponceau 6R 108	None		27·15	Genuine syrup.
77864	"	Amaranth 107	Benzoic acid	0·0980	45·39	Genuine fruit.
77866	"	None	"	0·1342	24·86	Genuine syrup.
77965	"	"	Salic. acid	Trace.	12·90	Genuine fruit.
77966	"	Ponceau 3R 56	Benz. acid	0·0929	22·56	Genuine syrup.
77970	"	Amaranth 107	Formalin	0·0174	0·00	Synthetic syrup.
77971	"	None	Benz. acid	Trace.	37·14	Genuine fruit.
77972	"	"	Formalin	0·0054	13·28	Genuine fruit.
74084	"	Artificial	Salic. acid	0·0168	42·07	Genuine fruit.
75328	Winnipeg	Palatine Red 62	Benz. acid	Trace.	33·12	Genuine syrup.
52696	"	Amaranth 107	"	"	26·28	Genuine syrup.
52701	"	" 107	None		42·38	Genuine syrup.
68423	Vancouver	Ponceau 3R 56	Benz. acid	0·057	11·31	Genuine, syrup.
75923	"	Erythrosin 517	"	0·001	59·50	Doubtful syrup.
75930	"	Ponceau 3R 56	"	0·144	13·38	Genuine fruit.
75863	"	Crystal Ponc. 64	"	0·0932	35·34	Genuine syrup.
75867	"	Palatine Red 62	"	0·0568	37·40	Genuine fruit.

In the 27 samples of strawberry flavour examined, 2 were found to be synthetic preparations, 2 doubtful, and 23 genuine, 8 samples contained no preservative, 14 small amounts of soda benzoate, 2 salicylic acid, 2 formaldehyde and 1 alcohol. Of the 18 samples which were artificially coloured, but six contained an uncertified dye.

PINEAPPLE (22 samples.)

Sample No.	Analyzed at.	Dye.	Preservative.		Sucrose p. c.	Analyst's Description.
			Substance.	p. c.		
76606	Halifax	None	None			Genuine syrup.
76610	"	"	"			" "
78043	"	"	"			" fruit.
78050	"	"	Salic. acid	Trace.		" syrup.
71219	"	"	None			" "
7488	Ottawa	"	"		42·26	" "
65263	"	"	Formalin	0·0171	18·35	" "
65270	"	"	None		14·19	" "
72593	"	"	Formalin	0·0876	43·59	" "
77512	"	"	Benz. acid	0 0929	50·14	" "
77514	"	Artificial	Alcohol	35·51	15·34	Synth. "
77865	"	None	Salic. acid	0·0544	56·46	Genuine fruit.
77869	"	"	Benz. "	0·1548	57·18	" syrup.
77967	"	"	None		19·86	" fruit.
75325	Winnipeg	"	"		36·16	" syrup.
52697	"	"	"		17·32	" "
68420	Vancouver	"	Benz. acid	0·045	48·29	" "
68443	"	"	" "	0·009	46·80	" "
75922	"	"	" "	0·020	60 85	" "
75931	"	"	" "	0·101	39·37	" fruit.
75864	"	"	" "	0·1084	55·81	" syrup.
75868	"	"	None		1·28	" fruit.

There was but one synthetic syrup in the twenty-two samples of pineapple flavour examined. This preparation was the only artificially coloured sample. Ten samples contained no preservative other than sucrose, seven contained benzoate of soda, two salicylic acid, two formaldehyde and one alcohol.

CHERRY (21 samples.)

Sample No.	Analyzed at.	Dye.	Preservative.		Sucrose p. c.	Analyst's Description.
			Substance.	p. c.		
78047	Halifax. ...	Ponceau 3R 56....	None	.....	.....	Gen syrup.
71220	"	Amaranth 107 ...	"	.....	. . ...	Doubt. syrup.
7487	Ottawa.....	" "	Salic. acid	0·046	49·26	Gen. "
72597	"	" "	" "	0 006	11·16	" "
72599	"	" "	" "	0·004	47·79	" "
77513	"	None	" "	0.016	22·15	" fruit.
77517	"	Palatine Red 62...	None...	.....	17·95	" syrup.
77533	"	Ponceau 3R 56....	Formalin*.....	0·003	1·40	" fruit.
77572	"	Napth. Yel. S 4...	Salic. acid*..... .	0·019	15·22	" " (mint).
77867	"	Palatine Red 62...	None...	.....	4·75	" fruit.
77964	"	Artificial..... . .	Salic. acid	0·012	39·66	" "
74085	"	Magenta 448.....	" "	0·023	32·91	" "
75327	Winnipeg.....	Palatine Red 62...	Benz. "	Trace.	22·49	" syrup.
79508	"	Cryst. Ponceau 64	None..	... .	66·30	" "
52731	"	Amaranth 107. ...	"	.....	51·70	" "
68418	Vancouver-..	Ponc. 3R 56..... .	Benz. acid.....	0·054	6·54	" "
68441	"	Amaranth 107.....	" "	0·094	16·69	" "
75925	"	" "	" "	0·01	46·36	" "
75928	" ...	Ponc. 3R 56.....	" "	0·076	3·47	" fruit.
75869	" ..	None	None.....	.....	1·28	" "
75871	"	Amaranth 107 ...	Benz. acid	0·111	8·36	" "

* Benzoate declared.

Of the twenty-one samples examined, one was doubtful, the remaining twenty genuine. All were found to be coloured but two, thirteen with certified dyes and six with others. Seven contained no other preservative than sucrose, six sodium benzoate, seven salicylic acid and one formaldehyde.

Six samples (Nos. 77513, 77533, 77867, 77964, 75928 and 75871) were labeled and sold as "Maraschino cherries." Steps should be taken to require manufacturers of this class of goods to label their product in a less deceiving manner, since these were not maraschino cherries. The following extract from Food Inspection Decisions, United States Department of Agriculture, F.I.D. 139 (Chem. Abst. 6, (1912), 1473) first defines the term, then places regulations on the labeling of products similar to the above: "Maraschino is a liqueur or cordial prepared by fermentation and distillation from a small wild Dalmatian cherry. Imitations of maraschino should be labelled "imitation." Cherries of other varieties preserved in maraschino liqueur may be called "cherries in maraschino," or if preserved in a syrup flavoured with maraschino alone, may be called "cherries, maraschino flavour" or "maraschino flavoured cherries." Sample No. 75869, put out by the Liquid Carbonic Company of Chicago, conforms to the above: it is labeled "cherries, imitation maraschino flavour."

LEMON (18 samples.)

Sample No.	Analysed at.	Dye.	Preservative.		Sucrose p. c.	Analyst's Description.
			Substance.	p. c.		
76601	Halifax	Tartrazine 94	None			Doubtful syrup.
78042	"	"	"			Synthetic syrup.
78048	"	None.	"			Genuine syrup.
71215	"	Tartrazine 94	"			Synthetic syrup.
71217	"	Orange 1 85.	Salic. acid	Trace		" "
71221	"	Tartrazine 94	None			" "
71222	"	Artificial	"			" "
5652	Ottawa	Napth. Yel. S 4	Salic. acid	0·023	54·54	Genuine syrup.
7486	"	None	"	0·031	39·49	" "
65265	"	"	None		63 92	" "
72596	"	Auramine 425	Formalin	0·022	32·62	" "
72600	"	"	None		57·36	Synthetic syrup.
77851	"	Tartrazine 94	Salic. acid*	0·034	2·09	Genuine syrup.
74081	"	Quin. Yel. 667	None		44·18	" "
52693	Winnipeg	None	"		46·18	Doubtful syrup.
68419	Vancouver	Napth. Yel. S 4	"		57·42	" "
68442	"	"	Benz. acid	0·063	55·76	Synthetic syrup.
75862	"	"	None		47·07	" "

* Benzoate declared.

Genuine flavours, 7; synthetic, 8; doubtful, 3. The dyes show a better proportion, only four samples being coloured with uncertified dyes. Twelve samples were found to be preserved with sucrose alone, four with salicylic acid and one each with sodium benzoate and formaldehyde. The explanation for the large percentage of synthetic preparations of this flavour is probably found in the fact that of all flavours, lemon and orange are the easiest and probably the most commonly reproduced. It is well known that the so-called "circus lemonade" is nothing but a water solution of citric or tartaric acid, sweetened and coloured.

ORANGE (15 samples).

Sample No.	Analyzed at	Dye.	Preservative.		Sucrose. p.c.	Analyst's description.
			Substance.	p.c.		
76608	Halifax	None	None			Gen. syrup.
78041	"	Artificial	"			Comp syrup.
71218	"	Orange 1 85.	Salic-acid	0·023		"
5653	Ottawa	Meth. Orange.	Formalin	0·014	33·06	"
7485	"	Orange 1 85.	Salic. acid	0·015	52·72	Genuine syrup.
65260	"	Artificial.	Benz. acid	0·057	59·65	"
77516	"	Orange G 14	Salic. acid	0·020	00·00	"
77868	"	Croceine Or. 13.	Benz. acid	0·170	2·61	"
78612	"	Orange IV 88.	Formalin	0·013	00·00	"
75326	Winnipeg	None	None		00·00	Syn. syrup.
79506	"	Orange 11 86.	Benz. acid	Trace.	30·39	"
52696	"	Croceine Or. 13.	"	"	20·82	Doubt. syrup.
52699	"	None	None		59·40	"
68417	Vancouver	Orange 11 86.	"		60·24	"
75926	"	"	Benz. acid	0·013	54·88	Syn. syrup.

Six genuine, three compound, three synthetic and three doubtful. Ten samples were found coloured with forbidden dyes. This must be due to ignorance since no samples were more brilliant in colour than those dyed with orange 1 85. Five samples contained no added preservative (one, No. 75326, not even sucrose), three salicylic acid; five benzoic acid; two formaldehyde.

RASPBERRY (11 samples.)

Sample No.	Analyzed at	Dye.	Preservative.		Sucrose. p.c.	Analyst's description.
			Substance.	p.c.		
78049	Halifax	Amaranth 107	Benz. acid	0·032		Doubt. syrup.
71223	"	"	None			Gen. syrup.
72594	Ottawa	None	Formalin.	0·089	11·36	Gen. fruit.
77535	"	Amaranth 107	Benz. acid	0·266	1·23	Gen. syrup.
77969	"	"	Salic. acid	0·017	37·14	"
74082	"	"	None		55·76	Doubt. syrup.
75330	Winnipeg	Palatine Red 62	Benz. acid	Trace.	21·57	Gen. syrup.
52702	"	Amaranth 107	None		38·59	Doubt. syrup.
68421	Vancouver	"	Benz. acid	0·181	1·30	"
75866	"	"	"	0·059	13·73	Gen. fruit.
75924	"	Ponceau 3R 56	"	0·019	48·46	Gen. syrup.

Out of eleven samples examined, seven were found to be genuine and four doubtful. Only one sample was coloured with an uncertified dye. Three samples contained no preservative, six benzoic acid, one salicylic acid and one formaldehyde.

VANILLA (7 samples).

Sample No.	Analyzed at.	Dye.	Preservative.		Sucrose. p. c.	Analyst's description.
			Substance.	p. c.		
76607	Halifax	None	None			Gen. syrup.
78044	"	"	"			" "
5654	Ottawa	"	Formalin	0·018	36·59	Syn. "
5655	"	"	Salic. acid	0·011	37·08	Gen. "
74083	"	"	None		57·49	" "
75334	Winnipeg	"	"		56·82	" "
52698	"	"	"		50·59	" "

There was but one synthetic preparation (flavoured with coumarin) in the seven samples examined. Aniline dyes were found in none, though No. 75334 was coloured with caramel. Two contained small amounts of foreign preservatives, salicylic acid and formaldehyde.

CHOCOLATE (6 samples).

Sample No.	Analyzed at.	Dye.	Preservative.		Sucrose.	Analyst's description.
			Substance.	p. c.	p. c.	
76603	Halifax...	None.....	None.....	.....	.....	Gen. syrup.
72592	Ottawa. . . .	"	"	.....	48·66	" "
72595	"	"	"	.....	29·82	" "
72598	"	"	"	.....	43·98	" "
79511	Winnipeg.....	"	"	.....	61·60	" "
52700	"	"	"	.....	44·40	" "

No comment is necessary on the above; it speaks for itself.

PEACH (3 samples).

Sample No.	Analyzed at.	Dye.	Preservative.		Sucrose.	Analyst's description.
			Substance.	p. c.	p. c.	
65262	Ottawa.....	None.....	Formalin.....	0·050	44·17	Gen. syrup.
77871	"	"	Benz. acid.....	0·059	17·31	" "
75870	Vancouver....	"	"	Trace.	31·58	" "

All genuine, none dyed. Two were preserved with sodium benzoate and one with formaldehyde.

MISCELLANEOUS (11 samples).

Sample. No.	Analyzed at.	Flavour.	Dye.	Preservative.		Sucrose.	Analyst's description.
				Substance.	p. c.	p. c.	
76604	Halifax.....	Coffee.....	None..	None.....	.....	.....	Gen. syrup.
76609	"	Ginger.....	"	Salic acid...	Trace.	.....	" "
71224	"	Sarsaparil..	"	None.....	.....	.....	Syn. "
65259	Ottawa.....	Rose.....	Aniline Yel. 7.....	Formalin...	0·018	45·88	Doubt. "
77870	"	Fig.....	None	Benz. acid..	0·170	43·08	Gen. fruit.
77872	"	Claret. ...	Artificial.....	Salic. " ..	0·019	51·40	Doubt. syrup.
77968	"	Grape. ...	Indigotine P. 693..	Benz. " ..	0·075	00·00	Syn. "
75865	Vancouver....	Rainbow...	Erythrosin 517....	" " ..	0·170	8·74	Gen. fruit.
75929	"	Apricot. ..	None.	" " ..	0·082	29·88	" "
68422	"	Banana....	Ponceau 3R 56...	" " ..	0·110	42·60	Syn. syrup.
75927	"	" . ..	None.....	" " ..	Trace.	56·26	" "

Six genuine, four synthetic and two doubtful. Three samples were coloured with uncertified dyes. Six were found to contain sodium benzoate, two salicylic acid, and one formaldehyde.

In the collection were found three extracts (7451, lemon; 7495, vanilla; 7450, pineapple) and a soft drink (No. 75331, loganberry) collected by mistake.

Summary.—In the total number of syrups examined (141), one hundred and four were found to be genuine, twenty-two synthetic and fifteen doubtful. There were only thirty-one samples coloured with uncertified dyes. Fifty-eight samples contained no added preservative, forty-seven benzoic acid or benzoates; twenty-two salicylic acid; twelve formaldehyde and two alcohol. Such low percentage of synthetic preparations and syrups coloured with uncertified dyes in this representative collection, indicates that it will be a comparatively easy matter to enforce the standards as recommended in the first part of this report.

GEO. H. BROTHER,
Assistant Analyst.

BULLETIN No. 391—CANNED FISH.

OTTAWA, 30th January, 1918.

SIR,—I have the honour to report upon the examination of 275 samples purchased by our inspectors as Canned Fish. The collection was made in June, July and August, 1917, and may be classified as follows:

Salmon	166 samples.	Shrimp	1 sample.
Sardines	39 "	Abalone	1 "
Herring	20 "	Bloater	1 "
Lobsters	9 "	Trout	1 "
Clams	6 "	Spratts	1 "
Finnan Haddie	6 "	Crab	1 "
Oysters	5 "	Small Fish	1 "
Mackerel	5 "	Corned Beef (by mistake)	1 "
Tuna	5 "		
Scallops	4 "	Total	275 "
Cod	2 "		

The following points have been kept in view in this examination:

1. The soundness and quality of the fish.
2. The corrosion or other spoiling of the container (tin.)
3. Net weight of contents, total.
4. Net weight of contents, solid.

Salmon.—Out of a total of 275 samples, our inspectors have purchased 166 samples of Salmon; indicating that this is by far the kind of fish most in evidence. 138 of these samples represent what are generally assumed to be *one pound* tins; 28 samples represent nominal half pound tins.

Of the samples contained in 1 pound tins, 110 are sound and good; 7 show softened and more or less disintegrated flesh, but nothing to indicate decomposition. These samples are probably several years old. Three samples are spoiled by decay. In 18 samples the tin is slightly corroded, and the contents stained with iron. These, like those showing softened flesh, are presumably several years old.

Of samples contained in half pound tins, 26 were found to be in good condition; 2 samples showed more or less corrosion of the container, but the contents were good

The net weight contents of these tins is fairly satisfactory, approximating 16 to 17 ounces in the nominal one pound tins, and 8 to 9 ounces in the half pound size.

If, however, the drained solids are considered, while these approximate 14 ounces in most samples, the variation in weight is noteworthy. Thus:

For nominal 1 pound tins.

Samples containing more than	14	ounces	.....	26
" "	13	"	.....	63
" "	12	"	.....	39
" "	11	"	.....	10
Total			.....	138

For nominal ½ pound tins.

Samples containing more than	8	ounces	.....	2
" "	7	"	.....	14
" "	6	"	.....	11
" "	5	"	.....	1
Total			.....	28

The excess net weight, above the solids, is of course water. Inevitably more or less water must be present, and this averages about 3½ ounces for the one pound tins, and about 2 ounces for the half pound tins. I think it desirable that any statements of weight of contents should refer definitely to the solid contents only, which alone have actual value to the consumer.

Sardines.—39 samples are reported. Of this number, 28 were found to be in good condition. In one case only were the contents spoiled by decay. In 10 samples the tin container was more or less attacked, but the contents were sound. These samples are presumably old stock.

Herring.—Of 20 samples examined, 14 were found to be in good condition. In 6 samples, the tin container was more or less blackened; but the contents were sound.

These fish unlike the salmon are not packed in containers of approximately uniform size. The dry solids vary all the way from 2 ounces to more than 16 ounces in quantity. It is greatly to be desired that containers of 1 pound and ½ pound size should be employed in packing herring, as well as salmon.

Lobsters.—Nine samples were examined and all were found to be in good condition. The solid contents varied from 3·8 ounces to over 8 ounces in weight.

The following suggestions are offered in connection with this investigation.

1. It is much to be desired that the date of packing should be stamped on the tin, in the case of fish products.

2. Tins of standard size, in definite relation to the weight of 1 pound should be used in packing fish.

3. The weight of contents should appear on the tin, and should have reference to the solid matter.

4. The food value, expressed in calories, should be printed on the label. It would probably be simpler to state this in calories per pound of solid matter, for the contained species, than for the actual contents of the tin. If the actual weight of contents were given, the actual calorific value of contents could be easily calculated.

Another, and possibly a better way of expressing the food value, would be to state the value in proteids and fat for the contained species. This should be stated in ounces per pound. Thus: for Salmon = each pound contains 3·157 ounces of proteids and 1·718 ounces of fat. (Konig.)

BULLETIN No. 392—SAUSAGES.

OTTAWA, December 29, 1917.

SIR,—I have the honour to hand you a report upon 123 samples of sausages, purchased variously throughout Canada by our inspectors. The order for collection was issued in August last, but inspectors were instructed to await special instruc-

tions from the analysts, so that samples might be dealt with promptly upon being received at the laboratories. This condition was necessary, on account of the readily perishable character of the article.

Departmental standards for sausages, as published in Circular G. 931, of October, 1910, require as follows:—

> 2. Sausage, sausage meat, is a comminuted meat from swine or neat cattle, or a mixture of such meats, either fresh, salted, pickled or smoked, with added salt and spices and with or without the addition of edible animal fats, cereals, blood and sugar, or subsequent smoking. It contains no larger amount of water than the meats from which it is prepared contain when in their fresh condition, and not more than ten (10) per cent of its weight of cereals; and if it bears a name descriptive of kind, composition or origin, it corresponds to such descriptive name. All animal tissues used as containers, such as casings, stomachs, etc., are clean and sound and impart to the contents no other substance than salt.
>
> 3. Blood sausage is sausage to which has been added clean fresh blood from neat cattle or swine in good health at the time of slaughter.

Nothing is said as regards the employment of dyes in sausages; but this matter is covered by an Order in Council of January 9, 1915 (published as Circular G. 1167), which requires that, so far as all except certain named classes of foods are concerned, "the presence of artificial colouring matter must be declared upon the label in easily legible type." A list of permitted dyes is also furnished in the circular referred to.

The difficulty of carrying out the provisions of G. 1167 in the case of sausages will be at once apparent. It might be possible to secure the proper labelling of the article by the large manufacturer; but. in selling at retail, as well as in the case of smaller makers of sausages, whose trade is purely local, the difficulty would be so great as to be practically insurmountable. At least, this is the claim of the trade.

Recognizing this fact, the Veterinary Director General has prohibited altogether the use of dyes in sausages manufactured in establishments under supervision of inspectors of the Department of Agriculture; and the regulations thus authorized have been faithfully carried out by inspected factories. There exist, however, a very large number of smaller factories, which, not doing an interprovincial or export trade, are not subject to supervision under the terms of the Meat and Canned Foods Act. Certain of these smaller factories have found it profitable to use dyes in their products, and in some localities a very considerable demand for sausages made with dyed meat is claimed to have been developed, to the injury of those manufacturers who are forbidden to employ dyed meats.

The collection herein reported was intended to include only the products of such factories as are not working under the inspection of the Department of Agriculture; and our inspectors were especially instructed to secure, for analysis, only sausages of the kind indicated. Most of the samples, as will be seen, are manufactured locally, and are made by the immediate vendor of the article. Out of the whole number (123) only four (4) samples are found to be made with dyed meats, one in Halifax, the other three in Ottawa. If this result may be taken to indicate the extent to which sausage meats are dyed in Canada, it must be held that this usage is very limited.

In four other instances, the casing of the sausage is dyed; but this does not constitute a violation of G. 1167 in Bologna sausage, where the casing is not eaten, and where the dye does not penetrate to the edible portion of the sausage.

I have, of necessity, adjudged the four cases above referred to, as adulterated under the Act; but in view of the recognized difficulty already mentioned of labelling sausages, I may be permitted to recommend leniency, without prejudice to further

decisions of the kind. Should later investigation show that the dyeing of sausage meats has any considerable vogue, it may be advisable to suggest a means by which the public shall be properly informed of the presence of a dye other than the use of a label.

Another matter regarding which complaint has been made, is the introduction of excess of cereals into sausage, with a view to reducing the cost and of enabling a higher water content to be held than would otherwise be possible.

Our standards permit 10 per cent by weight of cereal to be present, and this limit is not reached by any of the samples now reported. I am inclined to believe that our limit for cereals is quite unnecessarily high. In some States of the American Union the limit permissible is fixed at two (2) per cent; and the fact that only 26 samples out of 123 samples are found to contain above 5 per cent of starch would seem to indicate that our present limit is excessive.

It is usually assumed that cereals are employed for the purpose of enabling a large amount of water to be held by the sausage. There is nothing in the results herewith furnished which could justify such assumption in the samples analyzed. The highest water content is found in samples containing very little cereal; in some cases less than one per cent, and conversely, samples with a high cereal content are found to contain very reasonable water percentage.

Moisture in Sausages.—This is required to be present in no larger amount than the meats from which they are prepared contain when in their fresh condition. It becomes important, in this connection, to ascertain and fix legal limits for this amount. The following data are available:—

Quoted from "Food Inspection, etc.," A. E. Leach, 2nd Edn., pp. 213 to 216. The tables are calculated from experimental work by Atwater:—

—	Beef.	Veal.	Mutton.	Lamb.	Pork.
Chuck					
Lean	71·3	76·3	61·7		
Medium	68·3	73·3	50·9	56·2	
Fat	62·3		40·6		
Ribs					
Lean	66·0	72·7			
Medium	55·5	60·9			
Fat	48·5				
Loin—					
Lean	67·0	73·3			60·3
Medium	60·6	69·0	50·2	53·1	
Fat	54·7	61·6	43·3		41·8
Rump-					
Lean	65·7				60·0
Medium	56·7				
Fat	47·1				38·7
Round—					
Lean	70·0				
Medium	65·5				
Fat	60·4				
Leg—					
Lean		73·5	67·4		
Medium		70·0	62·8	63·9	
Flank—					
Medium			46·2		
Shoulder					51·2

König, quoted by Allen, "Com. Org. Analysis," Vol. VIII, 4th Edn., p. 262, gives the following percentages, which refer to the whole animal:—

Ox—very fat	55·42
" medium	73·25
" lean	76·71
Cow—fat	70·98
" lean	76·35
Mutton—very fat	47·91
" medium	75·99
Horse flesh	74·27

The following are supplied by the authors named, and are quoted from Allen v.s.:—

Average ox flesh	76·7	(Munk's Physiologie).
" calf's flesh	75·6	" "
" pig's flesh	72·6	" "
" horse's flesh	74·3	" "
" fowl's flesh	70·8	" "
Mutton chop (boneless)	44·1	(Church).
Calves' liver	72·3	(Payen).
Sheep's kidneys	78·2	"

It will be noted that pig's flesh (pork) contains decidedly less water than other flesh, and it is chiefly from pork that ordinary sausages are made. Taking this into account, it would appear that 70 per cent of water is a reasonable maximum amount of water which may be tolerated in the flesh content of sausage. The addition of cereals, up to 10 per cent, is permitted, and these usually contain no more than about 10 per cent of water. As a matter of fact, the samples (123 in number) herein reported contain decidedly less than 70 per cent of water, and the following synopsis is of interest and importance:—

Samples containing over 65 per cent water	7
" " 60 to 65 per cent water	19
" " 55 to 60 per cent water	34
" " 50 to 55 per cent water	33
" " less than 50 per cent water	30
Total	123

The great majority of samples of this collection shows less than 60 per cent water; and I am of opinion that a limit of 60 per cent water in sausage would not be unreasonable where the sausage was made from meats containing a proper proportion of fat. In the case of sausage described and sold under a name which implied the use of lean meats, a somewhat higher percentage of water might be tolerated.

It is impossible to overlook the extremely varied prices at which sausages are sold at retail. The following tabulated statement illustrates this, and at the same time gives an idea of the relation existing between actual value as a food and price per pound.

Sausages—Cost in Proportion to Nutritive Material.

Number of samples examined.	Retail price per lb. as sold.	Average water content.	Average solids.	Average cost per lb. of solid matter.	Arranged in order of low cost for equal nutriment
	cts.			cts.	
18	30	52·93	47 07	63·8	11
6	28	51·52	48·48	57·7	9
3	27	45·65	54·35	49·7	6
14	25	56·82	43·18	57·8	10
2	24	47·21	52·79	45·3	4
3	23	53·85	46·15	49·8	7
3	22	57·11	42·89	51·3	8
45	20	55 95	44·05	45·4	5
19	17	55·54	44·46	38·2	3
7	15	55·32	44 68	33·5	2
3	13	49·45	59·55	25·7	1
123					

Doubtless the high-priced sausages owe their sale in many cases to public confidence in the manufacturer, and to a claim for the use in their manufacture of selected material only. They are probably sold locally, or within restricted areas only. In some cases it may be that a special seasoning, or other individual character, may give them advantage in the market; but as regards nutritive value, the samples now reported must be judged entirely upon their content of dry material.

ADDENDUM.

22nd January, 1918

In my report, as above, it was shown that only four samples of sausages, out of a total of 123 samples, contained dyed meat. I have learned since writing this report, that the markets in which dyed sausages are chiefly sold, are quite restricted; and as the District of Montreal was not represented in the collection, I have caused a special inspection of this District to be made. The results of examination of 41 samples purchased by our inspectors in Montreal are given in Table II.

While the moisture and starch percentages found in these samples indicate nothing that requires special comment, it will be seen thaat 29 samples (forming 70 per cent of the collection) contain dyes. It is thus evident that the District of Montreal is one of the areas in which the dyeing of sausage meats is noteworthy.

In all these instances the character of the meats persent was satisfactory in the sense that these were sound and wholesome. The necessary inference is, that the demand for a coloured sausage is consequent upon conditions which may be regarded as abnormal, and more or less local. It may be that the foreign population of this city (Montreal) proportionably larger than in the country as a whole ,explains the matter. However this may be, it is quite apparent that some means of declaration of added colour must be devised and your Advisory Board will take this matter into consideration with a view to making recommendations.

A. McGILL,
Chief Analyst.

BULLETIN No. 393—SODIUM PHOSPHATE.

OTTAWA, February 27, 1918.

SIR,—I beg to hand you a report upon Sodium Phosphate, and Effervescent Sodium Phosphate.

Sodium Phosphate, otherwise known as *Sodii Phosphas* or *Di-sodium Hydrogen Phosphate,* or *Phosphate of Soda,* is one of the most widely used drugs of the pharmacopœia, and is thus described in the British Pharmacopœia, Edition 1914.

Characters and Tests. Transparent, colourless, rhombic prisms, efflorescent. Taste saline. Soluble in 7 parts of water, the solution being slightly alkaline to litmus. Yields the reactions characteristic of sodium and of phosphates. Five grammes dissolved in 50 millilitres of water require for neutralization not less than 13·9 millilitres of N/1 solution of sulphuric acid, solution of methyl orange being used as indicator. Yields no characteristic reactions for potassium, ammonium, carbonates, or chlorides, and not more than the slightest reaction for sulphates. Lead limit 5 parts per million. Arsenic limit 5 parts per million.

In the present report, this article is represented by 144 samples.

Non-effloresced crystals of sodium phosphate contain 60·33 per cent of water, and 19·83 per cent of phosphoric acid (stated as phosphoric anhydride, P_2O_5.)

The salt is highly efflorescent (i.e. loses water of crystallization in contact with air) and in consequence of this fact, its content in water is decreased and its content of phosphoric acid is proportionally augmented on prolonged keeping, unless proper

precautions are taken. Thus, the loss of 5 per cent of water would cause the phosphoric acid content to be raised to 20·5 per cent nearly; while loss of 10 per cent water would raise the phosphoric content to 21·1 per cent. By artificial drying to loss of 50 per cent of its water of crystallization, the phosphoric acid content is raised to 28·4 per cent, and it is quite apparent that many of the samples herein reported have been dessicated so as to cause the loss of even more than 50 per cent of normal water of crystallization.

In the manufacture of effervescent sodium phosphate it is necessary to dry the sodium phosphate; and the pharmacopœia prescribes drying to the loss of about 60 per cent of the weight of the salt. This treatment renders it practically anhydrous; and its phosphoric acid content would then be raised to 50 per cent by weight.

By continued exposure to the air, at ordinary temperatures, crystallized sodium phosphate is said to lose five out of its normal twelve molecules of water of crystallization. This would result in a salt containing 26·5 per cent of phosphoric acid. In all samples showing a higher percentage than 26·5, it is probable that these have been intentionally subjected to dessication, or have been for a long time kept in an abnormally dry atmosphere.

The result of dessication is to make the sodium phosphate content more than 100 per cent when calculated from the phosphoric acid found. The number thus obtained has however, a practical value; and should be known to the physician, if regard is to be had to the quantity prescribed. Thus, if a prescription calling for 100 parts of sodium phosphate is filled by a partially dried salt containing 26·5 per cent of phosphoric acid, the patient receives about one-third more of the drug than the physician directed. It will be seen, from the table, that a large number of these samples are so abnormal, that a given weight of them corresponds to much more than the same weight of sodium phosphate; in a few cases to nearly double that weight.

Sodium phosphate is prepared by the interaction of acid calcium phosphate with sodium carbonate. The acid calcium phosphate is itself prepared by treating a neutral calcium phosphate with sulphuric acid. It is well known that much of the sulphuric acid of commerce contains arsenic, derived from the raw material (pyrites) employed in its manufacture. In consequence of this fact, arsenic is frequently introduced into acid calcium phosphate, and thence into the sodium phosphate, prepared from it.

The occasional presence of notable amounts of arsenic in sodium phosphate was pointed out in 1909 (see bull. 181). Six samples of the drug were found to contain from 5 to 10 parts of arsenic per million.

The Pharmacopœia fixes the limit for arsenic at 5 parts per million, and this limit is legalized for Canada by Order in Council of October, 1912, (G. 1048). A recent report to the Local Government Board of Great Britain, by Dr. MacFadden, (1916-17) includes certain samples (about 50 in number) of acid calcium phosphate in which the arsenic was excessive, reaching as much as 400 parts per million. In one sample 643 parts per million were found. It is easily to be understood how arsenic, in considerable amount, may pass over into sodium phosphate manufactured from an acid calcium phosphate of such character.

Of 144 samples of sodium phosphate herein reported (Table I), 64 samples are found to contain no arsenic, or only negligible traces. Sixty-eight samples contain amounts not exceeding 5 parts per million, while 12 samples contain above 5 parts per million, the highest amount found being 25 parts.

Effervescent Sodium Phosphate (Sodii Phosphas Effervescens) is a mixture of sodium phosphate with sodium bi-carbonate and citric and tartaric acids. It is, in effect, a convenient mode of administering sodium phosphate; and contains about one third of its weight of this salt. The usual dose is about double that for sodium phosphate.

One hundred and sixty-nine (169) samples of this article are reported in Table II. So far as arsenic is concerned, they show as follows:—

No arsenic or traces only	74	Samples.
Less than 5 parts per million	94	"
More than 5 parts per million	1	"
	169	

It is evident, however, that these samples are chiefly made from sodium phosphate containing more or less arsenic, and the explanation of a better showing is the fact that only about one-third of the weight of the article consists of sodium phosphate.

A considerable deviation from the pharmacopœal formula is observed in many of these samples; and most of them contain decidedly more sodium phosphate than the formula demands. Two samples (7357 and 5022) are apparently merely sodium phosphate supplied by mistake. Only one sample contains arsenic in sufficient amount to call for comment.

Although none of the samples herein reported can be regarded as positively dangerous, in regard to arsenical content, it is sufficiently apparent that manufacturing chemists must test all samples of sodium phosphate for arsenic, and reject such as show more than the legal limit of 5 parts per million, if they would meet the requirements of the British Pharmacopœia. The United States Pharmacopœia fixes the limit for arsenic at 10 parts per million; and the Adulteration Act (Section 7b), recognizes this Pharmacopœia. When, however, any other standard than that set by the British Pharmacopœia is in question, we expect such authority to be quoted. Failing this, the standard of the British Pharmacopœia governs.

BULLETIN No. 394—WINES AND LIQUORS.

OTTAWA, February 12; 1918.

SIR,—I have the honour to hand you a report on 114 samples, purchased by various specific names, which may be included under the comprehensive title, Wines and Liquors.

An Order in Council of February 8, 1911 (published by this Department as Circular G. 947) defines the terms Wine, Beer, Whisky, Rum, Gin, etc., and the definitions given are consistent with the ordinary use of these terms. Recent legislation in several provinces of Canada has restricted or forbidden the sale of alcoholic liquors of the kinds referred to; and interested parties have, in some instances, placed on the market would-be substitutes for these, and have not hesitated to adopt the terms wine, beer, rum, etc., in describing such substitutes.

In consequence of such action, complaint has been made by purveyors of alcoholic liquors, and also by purchasers, who have been duped into buying wine which is not wine; whisky, which is not whisky, etc. Under the Order in Council above referred to, *Whisky, Brandy* and *Rum* are required to contain not less than 42.75 per cent (volume) of absolute alcohol, equivalent to 75 per cent by volume of proof spirit. *Gin* must contain not less than 37 per cent of absolute alcohol, equivalent to 65 per cent proof spirit.

Although a limit for alcohol is not fixed in the case of Wine, this article is defined as "the product of the normal alcoholic fermentation of the juice of sound ripe grapes, etc." Alcohol is therefore a normal constituent of Wine; and actual wines show amounts varying from about 10 to over 30 per cent of proof spirit.

It was in order to ascertain the facts of the case that our inspectors were instructed, in June of last year, to investigate the matter; and the results of their investigation are herewith furnished to you.

So far as the name under which the article is sold is concerned, the samples may be classified as follows:—

Sold as Whisky	10	samples.
" Rum	10	"
" Gin	14	"
" Wine	45	"
Alcohol	1	"

Sold as Brandy	12	samples.
" Medicated Wine	3	"
" Cordials, etc	11	"
" Beer or Porter	3	"
Total	114	

Fifty-three (53) samples are found to be true to name under which sold, and to meet legal standards for such article; thirteen (13) may be regarded as meeting the type, but are below standard requirements in one or other respect.

Thirty-nine (39) samples are clearly fraudulent, in the sense of claiming to be what they are not; while nine (9) samples I have judged as doubtful, in the absence of a standard for the term *Cordial,* under which name, or an apparent equivalent, these samples are sold.

Details are given below:—

LIQUORS which are below legal strength in alcohol (proof spirit).

	Number.	Sold as.	Proof Spirit strength.	Deficiency.	Opinion.
1	76676	Rum	71·05	3·95	Pass.
2	71075	Cognac	55·95	19·05	Adulterated
3	71081	Cognac	45·08	29·92	"
4	71084	Rum	50·74	24·26	"
5	73898	Brandy	57 09	17·91	"
6	77881	Port wine (unfermented)	12·97	.....	"
7	68439	Whisky	69·99	5·01	Pass.
8	75832	Gin	61·32	3·68	"
9	75839	Gin	60·29	4·71	"
10	75841	Brandy	72·20	2·80	"
11	75936	Gin	48·70	16·30	Adulterated
12	75940	Gin	58·14	6·86	"
13	75941	Brandy	64·10	10·90	"

The Order in Council fixing limiting percentages for proof-spirit strength, provides that liquors having a spirit strength below the standard may be legally sold "when the actual percentage is legibly and distinctly marked on each and every package, parcel, bottle, or other container of such spirits."

In none of the cases above referred to is this condition fulfilled. I would, however, respectfully suggest that proceedings be not taken in cases where the deficiency does not exceed five (5) per cent. This is in accordance with usual procedure; but must be regarded as an act of clemency, and not as establishing a binding precedent.

The following samples are sold as *Cordials,* or by a name which may be regarded as equivalent to this:—

	Number.	Sold as.	Spirit strength.	Sugars.	Opinion.
1	72578	Mint Cordial	1·86	14·07	Doubtful.
2	72579	Pineola	1·39	17·39	"
3	72580	Orange	1·74	17 01	"
4	72581	Black Cherry	1·39	22·81	"
5	77912	Creme de menthe	1·86	35·81	"
6	77913	" "	none.	34·07	"
7	77993	Anisette	3·44	40·80	"
8	77995	Tipperary Punch	none.	14·10	"
9	78000	Creme de menthe	0·12	27·53	"

A cordial is generally understood to be an aromatized and sweetened spirit, used as a beverage, a liqueur, and is so defined by Webster. This authority furnishes an

alternative definition; "Any invigorating and stimulating preparation, as a medicine, food or drink; as a peppermint cordial."

In the absence of any legally established definition of the term, I am unable to express a clear opinion as to the genuineness or otherwise of these articles. I am, however, convinced that such names as "Crême de Menthe" are generally understood to imply the presence of alcohol; and the sale of a non-alcoholic liquor under such a name should be regarded as adulteration.

Thirty-nine (39) samples are sold under names which are legally defined, and all of these samples are adulterated, in the sense that they are not what they claim to be.

Wines.—Wine is the product of the normal alcoholic fermentation of the juice of the grape. Twenty-seven (27) samples are sold as Wines; and these are not fermented; nor are they, in any case, products of the normal alcoholic fermentation of grape juice.

Gin.—Is a product of the distillation of alcohol from juniper berries, and should contain, along with the volatile oil of juniper, at least 65 per cent of proof spirit. Four (4) samples are sold as gin which fail to meet these requirements.

Brandy.—Is a product of the distillation of wine, and should contain at least 75 per cent of proof spirit. Three (3) samples are sold as brandy which fail to meet these requirements.

Porter.—Is required to possess a spirit strength of at least 6 per cent. Two (2) samples sold as porter contain less than 2 per cent.

One sample sold as *Whiskey*, one as *Rum*, and one as *Lager Beer*, fail to meet standard requirements for these beverages.

Doubtless these articles are manufactured and sold with intent to meet the requirements of provincial temperance legislation. They must, however, be compelled to bear properly descriptive names; otherwise they are adulterated under section 3 (*d*) of the Act.

All of these samples are technically adulterated. Whether or not it will be well to inflict penalty in these cases, I leave you to decide. I have expressed the opinion that they are not what they claim to be; and the above-quoted section of the Adulteration Act applies.

I would respectfully draw your attention to the fact, which becomes more and more evident as my correspondence increases, that in the majority of cases the manufacturers are meeting exceptional conditions to the best of their ability, and without any intention of violating the provisions of the Act.

Recent provincial temperance legislation has interfered with the legitimate business in alcoholic beverages, and it is not a matter of surprise that manufacturers should attempt to meet existing conditions.

Until our Act distinguishes between "misbranding" and "adulteration" I think it will be only fair to these people that the Department should exercise leniency in interpretation, and I would respectfully suggest that in all cases of technical adulteration of the kind referred to, no legal action be taken.

BULLETIN No. 395—CANNED CORN.

OTTAWA, 9th March, 1918.

SIR,—I beg to hand you a report upon the examination of 207 samples purchased by our inspectors as Canned Corn in August, September and October of last year.

The samples in question apparently represent 61 different brands, as ascertained by inspection of the labels. It is, of course, possible that several of these brands may be the product of a single factory, and may differ from each other only in name.

While samples of every brand found on the market have been examined it has not been considered necessary to work every sample, in cases where a large number of samples of the same brand have been supplied. The total number of samples upon which work has been done is 168.

This food material has been inspected on two former occasions. Bulletin No. 226 (July 1911) reports upon 146 samples and bulletin No. 285 (April 1914) upon 205 samples. With a single exception, the net contents of the cans closely approximate 20 ounces in the present collection; and the same is true of former collections. As regards the weight of solid matter, there is a somewhat more marked variation, and the following table shows the average results obtained, with the samples upon which work was done:

Name of Brand.	Samples Collected.	Samples Worked.	Mean Results as to Contents. (ounces).		
			Total.	Solids.	Liquid.
Bloomfield	1	1	20·6	17·4	3·2
British Canadian	3	3	20·7	17·0	3·7
Burford	2	2	20·2	19·5	0·7
Canada First	9	8	20·4	17·4	3·0
Colonist	2	2	19·6	16 9	2·7
Cresca	1	1	20·1	17 5	2·6
Crusader	6	3	18·7	14·3	4·4
Dreadnought	1	1	21·4	20·5	0·9
E. D. S	4	3	20·5	17·7	2·8
Egyptian	1	1	20·2	15·3	4·9
Essex	3	3	20·5	18·3	2·2
Excelsior	2	2	19·7	18·2	1·5
Faultless	1	1	20·8	20·8	0·0
First Pick	2	2	20 0	14·1	5·9
Fleur de lis	6	6	19·9	17·5	2·4
Frankford	2	2	20·1	18 2	1·9
Frontenac	1	1	20·6	18·0	2·6
Gazelle	4	3	20·1	16·1	4·0
Gold Bond	1	1	20·2	18·8	1·4
Gold Standard	3	3	20·4	18·2	2·2
Grand River	1	1	20·6	17·5	3·1
Harvest	1	1	20·1	17·0	3·1
Honeydrop	1	1	20·4	20·4	0·0
Horseshoe	3	3	20·2	19·0	1·2
Hygeian	7	7	20·0	18·2	1·8
Ice Castle	13	9	20·1	18·5	1·6
Lanceboro	1	1	21·3	19·3	2·0
Lennox	1	1	21·0	20·7	0·3
Lion	13	8	20·4	16·6	3·8
Little Chief	22	9	20·5	17·4	3·1
Log Cabin	3	3	20·6	18·9	1·7
Lynn Valley	12	7	20·4	16·2	4·2
Malkin's Best	1	1	21·0	14 3	6 7
Maple Leaf	7	4	20·5	17·3	3·2
Mountain Crest	3	3	19·9	15·2	4·7
Mount Yoe	2	2	19·5	18·3	1·2
No Vary	4	4	20·2	18 9	1 3
Old Homestead	5	5	20·2	17·2	3·0
Old Oak	1	1	20·3	15·5	4·8
Parliament	3	3	20·0	17·6	2·4
Peacock	1	1	20·0	18·9	1·1
Peerless	1	1	20·4	20·0	0·4
Poland	1	1	19·6	14·5	5·1
Pride of N. Falls	2	2	20·2	17·4	2·8
Primus	1	1	19·2	18·0	1·2
Pure Food	1	1	20·1	17·2	2·9
Puritan	1	1	17·5	12·2	5·3
Quaker	10	10	20·1	17·1	3·0
Red Seal	1	1	20·8	18 7	2·1
Sportsman	1	1	20·3	16·3	4·0
Sugar Corn	1	1	20·7	17·2	3·5
Swiss Bell	1	1	19·9	15·9	4·0
Tartan	2	2	20·3	16 2	4·1
Thames	2	2	20·9	19·7	1·2
Thistle	13	11	20·0	16·7	3·3
Victoria	2	2	20·5	15·4	5·1
Victory	1	1	20·3	14·4	5·9
Vine	2	2	20·7	19·7	1·0
Vulcan	2	2	19·3	15·2	4·1
White Rose	1	1	21·2	11·6	9·6
Wiley	1	1	20·4	19·9	0·5

It will be noted that, with few exceptions, the solid contents approximate 18 ounces, and this may be regarded as a normal amount. With one or two exceptions, the contents have been found to be in good condition. Only traces of sulphurous acid or sulphites are reported. This does not necessarily mean that bleaching with sulphites has not been done. Sulphurous acid is easily oxidized to sulphuric acid, and thus may not appear after the sample has been kept for some time. It is, however, quite apparent that this bleaching agent has been employed more sparingly than formerly, and it is to be hoped that its use will soon become a thing of the past. In 1911, 46 samples gave decided amounts of sulphites. In 1914 the number was much reduced; and the present report indicates a continued lessening of the amount employed, and in many cases, its entire absence.

The use of saccharin, as a sweetener, has likewise been discontinued.

BULLETIN No. 396—SALAD OIL.

OTTAWA, March 11, 1918.

SIR,—I beg to hand you a report upon 149 samples purchased as Salad Oil during the months August to November 1917.

Olive Oil has been employed as a food from very early times; and as far as I can learn, was the only vegetable oil used in English speaking countries, as a component of Salads, until comparatively recent years. In consequence of this fact, purchasers of Salad Oil, unless specially instructed by a label, or otherwise, assumed that they were getting Olive Oil.

Many other vegetable oils have been found to be eligible, for food purposes; and extended investigation has proved them to be, both as regards digestibility and energy value, practically equal to Olive Oil. Most of these, however, possess in their natural, or untreated condition more or less distinctive and characteristic flavours, which, while they may not be in the strict sense, objectionable, are only tolerated by usage, and on acquired taste, and are sufficiently obvious to make the substitution of these oils for Olive Oil, impracticable.

By skilful treatment, however, it has been found possible to remove these specific flavours, and thus to produce a bland oil, capable of being mixed with olive oil, or entirely replacing olive oil, without detection, except by discriminating palates. So far as Canada and the United States are concerned, Cotton Seed Oil has been very largely employed in this way, and of course, has been regarded as an adulterant, when substituted for Olive Oil without declaration of its presence.

In view of the natural desire of the manufacturer to find a market for new, and little known materials, it is perhaps not cause for wonder that the public should be left to find out for itself the facts of the case. Thus, substitutes for lard, made from tallow and various oils, were for a long time offered as Lard; mixtures of cane sugar with highly flavoured specimens of maple sugar, were offered as Maple Sugar; glucose syrup (corn syrup) posed as Honey; Milk, from which the fat had been removed by a machine, instead of by hand, as in the older fashion, is offered as separated instead of skimmed milk, etc. The list might be made a very long one. In none of these cases was any injury done to the health of the consumer; and in the long run, the truth of the matter was discovered and made public. It is, however, very regrettable, that any good food material should seek to pose for other than what it really is.

A great number of vegetable oils are capable of being refined in such a way as to become available for use as Salad Oils; and the following list was submitted to the Association of Official Agricultural Chemists, in Washington, D.C., in November, 1916.

Fats and Oils.

Edible fats and edible oils are such glycerids of fatty acids as are recognized to be wholesome foods. They are dry and sweet in flavor and odor.

Cacao butter, coca butter is the edible fat obtained from sound cacao beans either before or after roasting.

Coconut oil, copra oil is the edible oil obtained from the kernels of the coconut.

Cochin oil is coconut oil prepared in Cochin (Malabar).

Ceylon oil, is coconut oil prepared in Ceylon.

Corn oil, maize oil is the edible oil obtained from the germ of Indian corn (maize) (Zea mays L.)

Cotton seed oil is the edible oil obtained from the seed of the cotton plant (Gosspyium herbaceum, L. or other species of Gosspyium).

Olive Oil, sweet oil is the edible oil obtained from the sound, mature fruit of the olive tree (Olea europaea L.).

Palm kernel oil is the edible oil obtained from the kernels of the fruit of the palm tree (Eloeis guineensis L.).

Peanut oil, arachis oil, earthnut oil is the edible oil obtained from the peanut (Arachis hypogaea L.).

Poppy seed oil is the edible oil obtained from the seeds of the poppy (Papaver somniferum L.).

Rape seed oil, colza oil is the edible oil obtained from the seeds of the rape plant (Brassica compestris).

Soy bean oil, soja oil is the soluble oil obtained from the seeds of the soy bean plant (Dolichos soja L., Soja, Hispida, Sieb et Zucc., Soga japonica, Savilk, Blycine hispida, Maxim, Glycine Soja L.).

Sesame oil, gingili oil, teel oil, benne oil is the edible oil obtained from the seed of the sesame plant (Seseamum indicum, De Candolle L., Radiatum Schum and Thonn).

Sunflower oil is the edible oil obtained from the seeds of the sunflower. (Helianthus annuus L.).

In order, however, to secure proper protection to the producer as well as to the consumer, it is necessary to require that when any of the oils named seek a market as *Salad oils,* the specific name of the oil should appear on the label. Our own standards for edible vegetable oils (published as Circ. G. 1002) require that when Cotton Seed Oil is sold as Salad Oil, the fact that the article is cotton seed oil must be declared on the label. The regulation referred to should be amended to include available oils other than cotton seed oil. At the time these standards were promulgated, Cotton Seed oil was the only substitute for Olive Oil found on our markets. One sample of Peanut oil is included in the present collection. (No. 80420).

While the above named vegetable oils are recognized as possessing a food value practically equivalent to that of Olive Oil, and consequently as permissible substitutes for olive oil when properly described on the label, it is quite otherwise with mineral oils. These are indigestible and have no food value whatever. Certain liquid paraffins, carefully purified, possess value as drugs, and *Paraffinum Liquidum* is recognized by the Pharmacopoeia. But as foods they are without any value.

Thirty-one (31) samples of the present collection while sold as Cotton Seed Oil, are found to contain paraffin (mineral) oils in amounts varying from 3 to above 30 per cent.

Less than 10 per cent. mineral oil	4	samples.
Between 10 and 20 per cent. mineral oil	7	"
Between 20 and 30 per cent. mineral oil	13	"
More than 30 p c. mineral oil	7	"
Total	31	

These samples are sold without any declaration of the presence of mineral oil, and must be regarded as adulterated under the Act; which defines food as adulterated "if any substance has been mixed with it, so as to reduce or lower or injuriously affect its quality or strength" Section 3, (*a*).

The results of this examination may be thus summarized:—

SALAD OIL.

Samples found to be olive oil	86	genuine.
" " cotton seed oil, and so named on label	25	"
Samples found to be cotton seed oil but not declared as such	1	adulterated.
Samples found to be cotton seed oil but sold as olive oil	1	"
Samples found to be cotton seed oil and olive oil mixed, declared	1	genuine.
Samples found to be cotton seed oil with added mineral oil	31	adulterated.
Samples found to be peanut oil	1	pass.
Samples collected by mistake	3	
Total	149	